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German Patent Procedure

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IT IS quite generally recognized that the presence of certain conditions in Germany places her in a favorable position to compete successfully in a great variety of manufacturing fields. This makes it essential for American manufacturers employing new methods or machinery to protect the same against unauthorized German imitation, and the most effective protection is that obtained under the patent laws.

Patents are granted in Germany for new inventions, products, methods and machines capable of commercial utilization. To be patentable an invention must produce a "new technical effect." Saving of time and cost of production, an improved product, reduction in the number of parts of a machine, elimination of steps in a process, may all be classified as "new technical effects." Scientific formulas, ideas, principles, analytic methods, mere problems, are not patentable. The new use of an old substance or material may be patentable.

A patent for a method protects not only the method itself but also the direct product thereof. Foods and medicines are not patentable unless they are produced by a patentable method. In the case of a method patent for producing a new substance, all substances of like properties will be deemed to infringe the patent, unless the contrary is proven. There is a radical difference between the United States patent law and the German patent law in respect to the time when an application for patent must be filed. While under our patent law the inventor may, without losing any rights, publicly use and freely publish his invention for two years before applying for patent, under German law the right to a patent is lost unless application is made before the invention has been publicly used in Germany or before it has been described in public prints (less than one hundred years old) anywhere in the world. An exception to this rule is made in favor of applications which are filed under priority rights accorded by the International Convention. Many of the countries of the world, including the United States and Germany, adhere to this Convention which contains a provision that an applicant for patent in one of the Convention countries shall have a priority right of one year for filing applications in the other countries. Any publication or public use of the invention between the date of filing in the first country and the filing within one year thereafter in the other countries will not adversely affect the applicant's right to a patent.

It follows from what has been said above that German patent applications should be filed either (a) before the invention which it is desired to protect has been published anywhere or been publicly used in Germany, or (b) within one year of the date of the application for the United States patent. Sight must not be lost of the fact that if the invention has been published *before* filing patent application here, or if the invention has been used publicly in Germany *before* the date of the United States application, filing in Germany under the International Convention will be of no avail. To obviate any uncertainty as to obtaining valid German patent protection, the safest plan is to file patent application in Germany before the invention has been made public in any way.

The filing of a German patent application entails substantially the same steps as the filing of an application in the United States. In Germany any rightful owner of an invention, whether an individual, a co-partnership or a corporation, may file the application. One of the essential parts of the application is the description. This should be prepared with great care, not only for the purpose of facilitating the procedure in obtaining the patent but also in order that the patent, when obtained, may be of proper scope. An impression seems to prevail that the German Patent Office is highly technical in its treatment of patent applications and that many obstacles are met with before a patent is finally granted. It is the writer's experience, extending over many years, that when trouble is encountered in the prosecution of a German patent application it is more likely to be due to the unsatisfactory form of the description than to any fault-finding tendency on the part of the officials.

The German Patent Office, like the Patent Office in any other country, has its own rules and standards which must be complied with if satisfactory progress is to be made in obtaining a patent. In the description or specification which forms part of the application for a United States patent every feature of the machine or process, even though old in itself, must be fully described and its operation and coaction with other features explained at length, while in a German specification merely a very brief reference need be made to old and well known features and only the fundamental principles or "high spots" of the invention require complete elucidation. A striking example of the difference in standards between the two countries is found in a German patent and a United States patent now lying before the writer. Both patents cover the same

invention, a machine for making cast-iron pipe, the German patent containing less than two pages of printed matter and four figures of drawings, while the United States patent contains something over nine printed pages and nineteen figures.

The description must terminate with claims which point out what the applicant deems to be his invention, and it is not an infrequent experience for an official examiner in the German Patent Office, in the course of the procedure, to draft claims which he thinks the applicant is entitled to and offer such claims to the applicant. Many of the German examiners are genuine experts in the art or arts under their charge, and claims prepared by such an examiner are likely to be of real value.

Occasionally a question arises whether a given invention, which is valuable commercially but which may embody only slight structural changes in existing machines, has sufficient novelty or discloses the required amount of inventive character to warrant the grant of a German patent. In a case of this kind the German law provides for the grant of "Gebrauchsmuster" protection. The literal translation of "Gebrauchsmuster" is "Utility Model," and a Gebrauchsmuster patent, which is granted without previous examination as to novelty, is intended to protect inventions which are not of sufficient magnitude of importance to be covered by a patent proper. The maximum term or life of a Gebrauchsmuster patent is six years divided into two three-year periods, while the term of the principal patent or patent proper is eighteen years.

Where inventions of doubtful patentability are involved it is common practice to file simultaneously applications for Gebrauchsmuster and principal patent protection, a request being made of the Examiner that the Gebrauchsmuster application be permitted to lie dormant until it has been definitely determined whether the applicant is entitled to a principal patent. If a principal patent is granted the Gebrauchsmuster application is withdrawn and, conversely, if the principal patent is refused the application for the Gebrauchsmuster patent is pushed to completion. Simultaneous filing of the two kinds of applications is effected because the same rules of novelty apply both to Gebrauchsmuster and principal patents, viz.:—the application must be filed before the invention has been published anywhere in the world and before it has been in public use in Germany.

Grounds for Opposition

A few words with respect to the procedure in the German Patent Office may be of interest. After an application for patent has been allowed by the Examiner it is laid open for public inspection in a room in the Patent Office. Anyone who thinks he may be injured by the grant of the patent may enter opposition thereto within two months of the date that the application is laid open. Nearly all large German concerns carefully watch published applications and enter oppositions in such cases where there seems to be justification for doing so. The grounds of opposition are rather limited, either (a) that the invention is anticipated by some printed publication which may have been overlooked by the Examiner, or (b) that the invention was in public use in Germany before the date of the application for patent, or (c) that the applicant wrongfully obtained his knowledge of the invention from the opposer. Each party, the applicant and the opposer, may present proofs of his contention and on the basis of such proofs the Patent Office will render a decision either that the patent should be granted as applied for or perhaps modified in scope, or that the patent should be refused. Inasmuch as the average examiner makes a thorough examination of the applications in his charge and does not ordinarily pass an application until he is clearly convinced of its patentability, only a small percentage of oppositions results in favor of the opposers.

The opposition procedure just described relates only to principal patents or patents proper, applications for Gebrauchsmuster patents not being laid open for public inspection and not being subject to opposition.

If the opposition is finally decided in the opposer's favor the patent is refused, and if finally decided in the applicant's favor the patent is granted and the patent deed issued to him in due course. To maintain a German principal patent in force yearly taxes must be paid thereon. Immediately upon the close of the war and for some time thereafter these taxes were quite heavy, but recently the amounts have been reduced and, apparently, it is the policy of the German government to make the payment of taxes on patents as little burdensome as possible.

Regulations Covering Licenses

The German law contains a provision that a patent may be revoked at any time after three years from the day following the grant, if the patented invention is manufactured exclusively or mainly outside of Germany and imported into Germany. By virtue of a treaty between the United States and Germany this provision does not apply to German patents owned by United States citizens. It should be noted, however, that by another provision of the German law a patentee may be compelled to grant licenses under his patent if the grant of such licenses is in the interest of the general public. Cases in which patent owners have been compelled, against their will, to grant licenses are very rare.

Patent litigation in Germany is, as a general rule, less costly and protracted than in this country. The owner of a patent which has been infringed has the choice of two remedies, he may sue either to recover damages or to have the infringer punished. An infringement suit for the recovery of damages must be instituted within three years of the commission of the act of infringement, and a suit to punish the infringer must be begun before the expiration of three months from the time the patent owner learns of the infringement. The punishment for knowingly infringing a patent may be a fine or imprisonment not exceeding one year.

In the United States it is customary, before bringing suit, for patent infringement, to give the infringer notice and warning. This is also done in Germany, but great care must be observed in preparing such a notice because if a warning is unjustified or is worded in such manner as to hurt the credit of the person or concern to whom sent, or is sent merely in pursuance of trade competition, the sender of the notice is liable to a suit for damages. As the German law does not require the sending of a notice before instituting a patent suit, it is preferable to forego sending notice where there is any doubt whatever as to the facts.

Making Two-and-One-Half Million Blanks Every Day

By Ellsworth Sheldon
New England Editor, American Machinist

Enormous production of safety-razor blades entails special methods and machines—Each press blanks seven hundred blades per minute—Taking care of scrap

TWO-AND-A-HALF million razor blades per day! That is the present production of the Gillette Safety Razor Co. The shop capacity is even now being increased to double the production.

The material for this article was obtained in the Boston shops. It deals only with the tools used on eight punch presses that turn out upwards of 5,000 blades every minute of each working day.

A production job of the magnitude of this one cannot be conducted upon a practical basis by the use of any ordinary form of blanking tools. It requires tools of a highly developed and specialized character, so designed and constructed that the constant replacements made necessary by the great quantity of material passing through them can be effected without loss of time and with certainty of exact duplication. Indeed, the tool maintenance upon this part of the work alone constitutes almost a manufacturing job in itself.

The blanking presses shown in Fig. 1, as well as the sub-presses used in connection with them, were designed by Charles R. Gabriel of the E. W. Bliss Co., Brooklyn, especially for this work. Because of the extraordinarily large production demanded, and because of the fact that production must not seriously be interrupted by having one or more of the presses out of service for the replacement of tools, the designer was obliged as a necessary preliminary to work out a method of tool maintenance involving the routine of a manufacturing proposition.

The first article. The second will appear in an early issue.

The features of the blanking presses that are particularly noticeable are their rigidity and strength in comparison with the size and thickness of the blank they cut; their extremely short stroke—the full movement of the rams being but ¼ in.; and the high speed, 350 r.p.m., at which they run. Because of the speed it was necessary to substitute specially designed friction clutches and positive mechanical means of operating them in place of the usual wheel-dogs and keyed collars ordinarily used.

There are eight of the presses now in constant service, for each of which two complete sub-presses and sets of tools are provided, thus leaving one sub-press for each press always in the toolroom for regrinding or replacement of parts. These sub-presses are interchangeable in every respect, so that one may be taken from a press and another substituted for it without delay or uncertainty. They are held to the beds of the presses by clamps that are permanently attached to the latter, and they are not connected in any way to the press rams.

Each press is provided with a two-roll feed motion, operated by an adjustable crank on the press shaft opposite the flywheel; a wiping and oiling device to clean and lubricate the strip of stock just before it enters the dies; a stock reel mounted upon ball bearings; and a belt-driven rewinder to coil the strip of scrap as it emerges from the dies. Incorporated in the feed mechanism is a safety device that stops the press

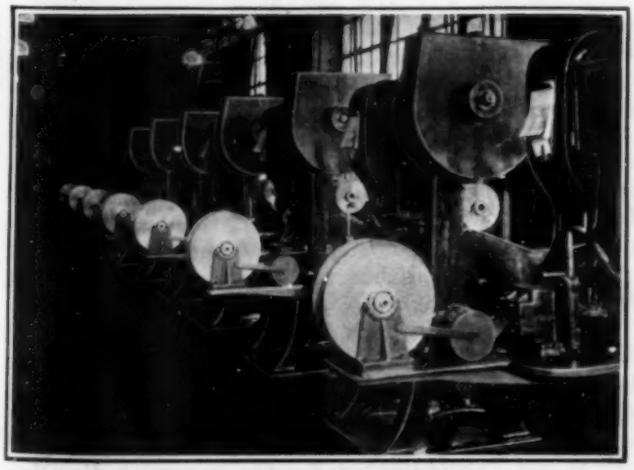


Fig. 1—The row of blanking presses

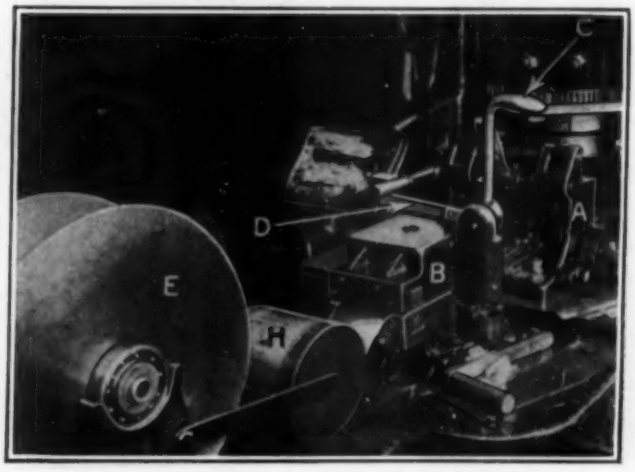


Fig. 2—The stock feeding mechanism

automatically when the coil of stock is all unwound from the reel, and before the end of the strip reaches the tools.

A close-up of the mechanism from the feeding side of the press, showing the various parts is to be seen in Fig. 2. The housing *A* carries the feed rolls, and is also provided with a vertically sliding shear blade, operable by means of a hand lever, to cut off the stock in case it is necessary at any time to remove the strip from the tools. The upper roll is vertically adjustable by means of toggle levers so that it may be lifted to release the stock at will of the operator, a condition that arises whenever a new strip of stock is to be started. A counter attached to the lower roll records the number of strokes made by the press.

The oiling device *B* consists of two parts, each of which contains reservoirs to hold the oil and two felt pads that bear upon the upper and lower surfaces of the strip of stock as it passes through the device, thus insuring that no particles of foreign matter adhering to the stock can enter the dies. The upper part of the device may be raised vertically by depressing the bent lever *C*, and may then be swung aside to clear the stock by a further movement of the same handle.

From the oiling device to the feed rolls, the stock passes between adjustable guides and over a smooth table, in the surface of which there is a small rectangular opening. Above the table and in position to enter this opening, is the downwardly projecting end of a stop lever, *D*, which bears upon the strip of stock as it passes over the table. When the end of the strip is reached, the end of the lever, no longer supported by the stock, drops into the opening in the table, and, being connected with the clutch release, it automatically stops the press.

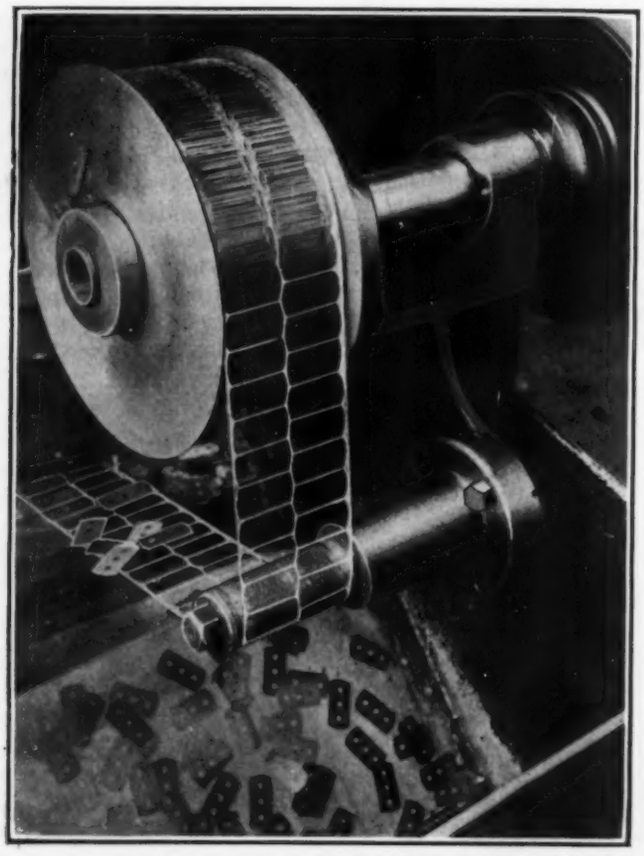


Fig. 3—The rewinder and scrap

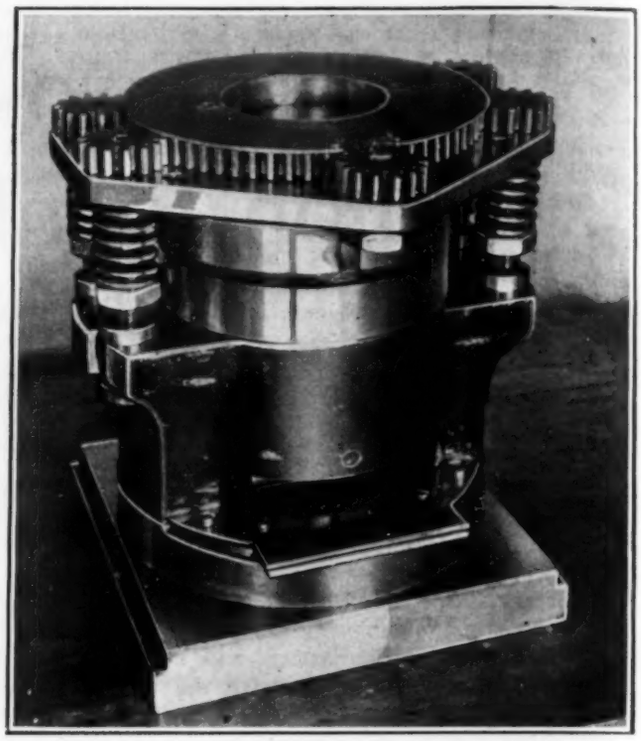


Fig. 4—A sub-press ready for service

The action of the release is positive and does not depend upon springs. A barrel cam on the end of the press shaft operates a small lever that is kept vibrating through a limited arc as long as the press runs. On the end of this lever is a hardened steel projection which normally will engage a latch on the draw-rod that releases the clutch, so that the press could make but one stroke each time it was tripped by the operator. While the end of the stop lever *D* rests upon the stock passing over the table, this latch is held out of engagement and the press runs continuously. The moment this support is withdrawn, the lever falls, engaging the latch and causing the cam to withdraw the clutch and apply a brake to stop the ram at the top of its stroke.

One flange of the stock reel *E* is removable and is held in place only by the yoke in which the reel rests. The reel turns on two ball bearings supported by open yokes, so that there are no bolts to be withdrawn and no latches to be disengaged when putting on a new roll of stock. The roller *H* is made of wood, and its purpose is to maintain a certain amount of slack in the strip between the reel and the feed rolls, in order to avoid the possibility of having the rolls start a stationary reel abruptly. Though the reel turns very easily on its ball bearings, its inertia would be sufficient to cause slippage of the stock in the feed rolls, and consequent uncertainty of feed, if the strip happened to be drawn taut at the moment the forward movement of the stock began. The weight of the roll *H*, which is freely suspended on its links, is sufficient to keep the stock reel always moving, and thus the condition above outlined is never encountered.

Behind each press there is a rewinder to take care of the strip of scrap as it emerges from the dies. It is belt-driven from the countershaft of the press at a speed calculated to keep the strip of scrap drawn fairly taut over the small roller below it when first started on the reel. Compensation for the increasing diameter of the coil is made by an adjustable spring-loaded fric-

tion coupling that allows the reel to lag behind the driving pulley. The rewinder may be seen in Fig. 3, with a full reel of scrap.

One of the sub-presses is shown in Fig. 4, completely assembled and ready to be set into a press. The clamps by which it is secured to the press bed are in the form of permanently attached gibs, under which the rabbeted base of the sub-press is made to slide. The work of exchanging one sub-press for another involves a shut-down of but seven minutes.

A small wheeled table, or truck, the platform of which is the same height from the floor as is the bed of the press—which is also the height of the bench in the toolroom whereon the tools are disassembled—is used to transport the sub-presses. To remove a set of tools from a press, the housing of the feed rolls is taken off, the clamps holding the sub-press base are loosened, and the sub-press is slid forward on to the planed surface of the bracket by which the feed motion is supported. One of the trucks is then backed up against the side of the bracket and the sub-press is pulled across the gap.

Another sub-press being in readiness upon its own truck, the truck is backed up in the place just vacated and the process is reversed. It is the duty of the tool maintenance department to see that there are always several sub-presses with newly reground tools in waiting, so that there will be no delay.

Removing and replacing the feed-roll housing is not so much of a job as might at first appear, since it is located by a tongue fitting a transverse slot in the bracket, and is held down by a couple of T-head bolts.

The plunger of the sub-press is not connected to the ram of the press. In the clamp of the ram there is a steel plug, or pusher, having a hardened face that abuts against a steel button in the top of the plunger of the sub-press and forces the tools down to make the cut. The coil springs of the sub-press return the plunger to its upper limit as the press ram recedes.

An Investigation of Twist Drills

AS A RESULT of certain investigations of twist drills made at the Engineering Experiment Station, University of Illinois, by Bruce W. Benedict and Albert E. Hershey, the following general conclusions may be drawn:

In drilling gray cast iron or steel, the power consumption at the drill point decreases as the helix angle is increased from 15 to 45 deg., being a minimum at that limit. The possible saving of power consumption resulting from the use of a larger helix angle varies with the machinability of the metal and with the drilling rate. This saving at fast feeds in steel of high machinability will exceed 30 per cent; in steel of low machinability, 8 per cent; and in cast iron, 25 per cent. At lower drilling rates the saving is approximately proportional to the rate of feed.

Drilling Rates and Effects

The torque on the drill and the thrust on the end of the drill decrease progressively as the helix angle is increased from 15 to 45 deg. Both are at a minimum in drills with a helix angle of 45 deg. With fast, but practical drilling rates, the possible reduction of the torque on the drill (obtained by increasing the helix angle from 26 to 45 deg.) will exceed 20 per cent in gray cast iron, 8 per cent in steel of low machinability, and 30 per cent in steel of high machinability. Under the same conditions, the possible reduction of thrust will exceed 21 per cent in gray cast iron, 28 per cent in steel of low machinability, and 41 per cent in steel of high machinability.

When drilling gray cast iron or steel, the drill endurance is not materially affected by changes in the helix angle from 26 to 45 degrees, inclusive, when the feed is normal and the metal of uniform structure. In certain carbon and alloy steels, however, when high drilling rates are used, the endurance of drills with helix angles above 35 deg. and below 28 deg. is less than that of drills with helix angles between these limits. The factor of endurance is governed more by the character of the material drilled and the condition of drilling, than by the size of the helix angle.

During the endurance tests in cast iron, it was observed that while the cutting eges of all the drills were intact, although dull, the sharp corners at the periphery were badly burned. After the critical condition at the sharp corner is reached, the high-angle twist drills break down more rapidly at a heavy drilling rate than those with a smaller helix angle. At the critical point, the high-angle twist drills are no longer cutting freely at the periphery and they break down rapidly at the corners from overheating. Since the sharp corner is the weakest portion of the cutting edge, endurance may be increased by grinding the corner to a definite curve.

When the two principal factors affecting drill design, namely the power consumption at the drill point and endurance of the cutting edge are considered, the most satisfactory performance in gray iron and steel is given by drills with helix angles ranging from 32 to 35 deg. Such drills are equally efficient in both cast iron and steel.

There is no apparent justification in reducing the helix angle from point to shank for the purpose of increasing chip space. Chip ejection from deep holes by drills so constructed is not better than that obtained by drills with constant helix angles.

These tests also showed that for 1-in. high-speed drills, a web thickness of 0.10 in., uniform from point to shank, proved adequate with helix angles above 32 deg. For drills of lesser helix angle, this thickness does not give the requisite tortional strength for drilling at high rates of speed in steel.

Machinability is a term used to designate the resistance of the structure of metals to the action of cutting tools, and it has been the practice to consider machinability and hardness as synonymous terms. Drill tests, however, show that machinability may be dependent on factors other than hardness. The torque measures the force required to separate the chips from the metal and is directly proportional to the resistance offered by the structure of the metal to the mechanical action of the cutting edge of the drill; hence the torque may be taken as the accurate measure of machinability. Test data prove that the machinability of steels determined in this way is not definitely related to their hardness as determined by Brindell tests.

Abstracted from Bulletin No. 159 of the Engineering Experiment Station, University of Illinois.

Book Reviews

Modern Tooling Methods for Turret Lathes. By M. E. Lange, production engineer, The Warner & Swasey Co. One hundred twenty-six pages, 6x9 in., limp cloth covers, illustrated. Published by the Warner & Swasey Co., Cleveland, Ohio. Price $1.25.

Practically all of the material contained in this book was published in a series of articles in the *American Machinist*. It was then issued in three catalogs, each one dealing with a separate part of the subject. Now it appears as a textbook, and rightly so, for, while it is a good advertisement for the business of the publishers, it contains information of great value to all who have to do with turret lathes, their tooling, operation and production.

As its title implies, the book is a thorough guide for better and more economical methods for tooling turret lathes. Examples of many set-ups for a variety of work are given by both description and illustration. To those who consider the turret lathe as a machine that is economical only on long runs, the book is a revelation, since it shows how the machine can be tooled for the economical production of a hundred pieces or less, and in some instances the piece and tooling costs for both long and short runs, are compared.

Mechanical World Electrical Pocket Book. Four-hundred and one pages, 4x6 in., 133 illustrations, cloth-board cover. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price 1s. 6d.

Comprising a collection of electrical engineering notes, rules and tables, the 1927 edition of the Mechanical World Electrical Pocket Book has been brought to date by the inclusion of several new sections. These additions deal with alternating-current commutator motors; time switches; electric signs, flashers and dimmers; electric pumping; and electric lighting and power in villages. Other sections have been revised by the introduction of illustrations and technical information.

In dealing with controlling appliances, many data are directed toward the installation requirements. The section devoted to pumping provides information relative to the selection of motors for driving piston and centrifugal pumps. Considerable space is devoted to the control and maintenance of electrical instruments used for testing and operating electrical devices. Throughout the volume are shown wiring diagrams, installation recommendations, principles of construction and constructional drawings, charts, and tables, applicable to electrical units. Diary and memorandum pages are included in the rear part of the volume.

Caravans of Commerce. By Isaac F. Marcosson. Three hundred and thirty-two pages, 5½x8½. Illustrated. Published by Harper & Brothers, New York City.

Mr. Marcosson's book is not only good reading—it is highly instructive as well. It grew out of a series of *Saturday Evening Post* articles describing the work of the United States Department of Commerce in developing foreign trade. The author's extensive travels have brought him into frequent contact with representatives of the Department in other lands and he speaks with authority of what he has observed.

The book is a real tribute to the splendid work done by Herbert Hoover in making a vital, productive force out of a government bureau. Its facts and statistics are enlivened by stories of the thrilling experiences of trade scouts in out-of-the-way corners of the world.

Perhaps the most gripping section of the book is that wherein foreign monopolies of raw materials are discussed. Every one knows of the struggle against the British Government control of rubber production but not so many are aware of what it has actually cost us in hard cash nor of how many other commodities might be monopolized to our disadvantage by other countries.

Every manufacturer who has any foreign trade will learn much from this book and the manufacturer who is concerned only with domestic trade will have his vision widened. Too many American manufacturers have failed to take advantage of the signal assistance and counsel available to them through the Department of Commerce. They owe it to themselves and to the country to learn what these facilities are and to make use of them.

Foreign Commerce and Navigation of the United States. Calendar Year 1925, Vol. II. Two hundred and seventy + xxxii, 9x12-in. pages. Published by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. Price $1.25. This volume contains twenty-three summary tables of foreign commerce including the total values of exports and imports by various classifications, arranged for comparison with previous years. Volume II contains also statistical tables Nos. 7 to 13, showing the foreign commerce of the United States in considerable detail. Two tables are included among the latter to show the number and the tonnage of vessels entered and cleared in the foreign trade.

The Care of Pneumatic Tools

By August Jeffers

THE life and efficiency of a pneumatic tool depends largely upon the care and treatment which it gets, first when working, and secondly when work is finished and it is laid by for the night or longer.

Always blow air through the hose pipe before connecting up in order to remove moisture and dust, also keep the air receiver and air mains well drained. After use, a pneumatic tool should have a charge of suitable oil blown through it to remove any moisture, the tool being gently worked to allow oil to spread through the working parts. Flaxseed oil is about as good as any for this purpose.

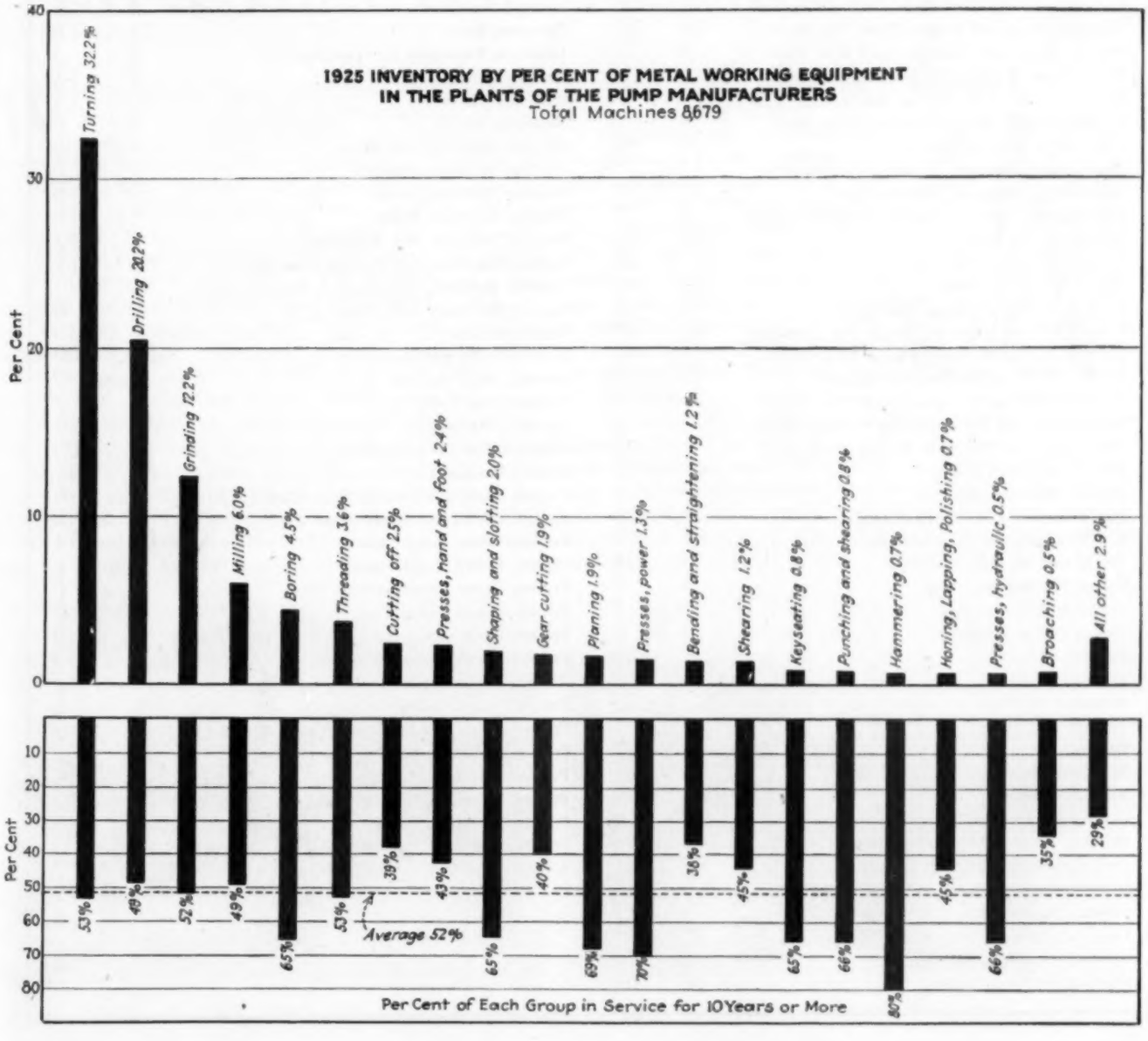
All air tools should be returned to the storeroom at the end of the day, and must never be left out in the open all night. All tools should be placed in a paraffin bath once a week to clean them of grit. Upon removal from the bath they should be dried out and then lubricated with oil before use, as paraffin is not a lubricant. Shanks or snaps of chisels, drills and reamers must be of correct dimensions. Defective shanks, if used, will ruin the hammer piston. Use only the best light oil for the hammers, and a good grade of heavier oil for drills.

Pumping Machinery Industry Works Against Handicap

Over 52 per cent of 8,700 metal working machines are ten years old

APPROXIMATELY 8,700 metal-working machines are at work on the manufacture of pumps and pumping machinery in the 126 plants listed by the United States Census of Manufacturers under this heading. The man power of the division is calculated to be nearly 14,500 total. The total of 126 plants includes all that employ six or more workers, and whose principal product is pumps. But 52 per cent of the equipment is, on the average, 10 years old or older.

These figures form the basis for the percentage chart shown below and for the detailed tabulation on the following page. They were obtained from a questionnaire sent by the *American Machinist* to this division of the metal-working industry.



METAL WORKING EQUIPMENT IN THE PUMP MANUFACTURING PLANTS

Kind of Machine Tool	A Number Built Before 1915	B Total Number in Plants 1925
Engine Lathes	819	1281
Hand Turret Lathes	168	336
Power Turret Lathes	189	432
Semi-Automatic Lathes	33	84
Hand Screw Machines	93	138
Automatic Screw Machines, Single Spindle	51	90
Automatic Screw Machines, Multiple Spindle	15	84
Chucking Lathes	6	102
Multiple Spindle Chucking Machines, Rotary Work	6	15
Multiple Spindle Chucking Machines, Rotary Tools	3	15
Speed Lathes	39	45
Bench Lathes	9	39
Tool Room Lathes	54	120
Wheel Lathes	9	9
Axle Lathes	0	0
Forge Lathes	0	0
Hand Milling Machines	21	42
Bench Milling Machines	3	3
Plain (Knee and Column Type) Milling Machines	99	219
Universal (Knee and Column Type) Mill. Mach.	84	153
Vertical (Knee and Column Type) Mill. Mach.	9	21
Lincoln Type Manufacturing Milling Machines	6	15
Semi-Automatic Type Milling Machines	6	21
Continuous Mill. Mach. Rotary or Drum Type	0	3
Planer Type Milling Machines	30	48
Gear Cutting Machines, Rotary or Milling Type	36	54
Gear Cutting Machines, Hobbing Type	21	69
Gear Cutting Machines, Planing or Shaping Type	9	39
Vertical Boring Mills	144	201
Horizontal Boring Machines	111	186
Radial Drilling Machines	153	366
Upright Drilling Machines, One Spindle	444	735
Upright Drilling Machines, Two or More Spindles	150	276
Upright Drilling Machines, Two or More Heads	15	39
Sensitive Drilling Machines, One Spindle	75	189
Sensitive Drilling Machines, Two or More Spindles	21	120
Sensitive Drilling Machines, Two or More Heads	3	6
Two-, Three- and Four-way Drilling Machines	6	18
Tapping Machines, Single	45	90
Tapping Machines, Multiple	0	0
Pipe Threading and Cutting Machines	75	123
Bolt Threading and Cutting Machines	42	69
Thread Chasing Machines	3	24
Thread Hobbing Machines	0	0
Thread Milling Machines	0	2
Thread Rolling Machines	0	0
Planers	111	156
Open-side Planers	3	9
Shapers	105	159
Vertical Shapers	0	3
Slotters	9	12
Broaching Machines	15	42
Keyseating Machines	48	72
Centering Machines	18	36
Grinding Machines, Plain Cylindrical	42	96
Grinding Machines, Universal Cylindrical	42	81
Grinding Machines, Surface, Reciprocating	9	45
Grinding Machines, Surface Rotating	9	27
Grinding Machines, Internal	12	39
Grinding Machines, Cylinder	9	15
Grinding Machines, Cutter	51	105
Grinding Machines, Floor, No Feed Attachments	300	426
Grinding Machines, Bench, No Feed Attachments	39	135
Grinding Machines, Disk	42	78
Grinding Machines, Belt	6	9
Grinding Machines, Centerless	0	6
Polishing and Buffing Machines, Wheel	24	48
Polishing and Buffing Machines, Belt	3	9
Polishing and Buffing Machines, Semi-Automatic	0	0
Lapping Machines	0	3
Honing Machines	0	0
Cutting-Off Machines, Parting Tool Type	9	33
Cutting-Off Machines, Power Hack Saw Type	57	123
Cutting-Off Machines, Rotary Cold Saw Type	12	30
Cutting-Off Machines, Band Saw Type	9	27
Cutting-Off Machines, Friction or Hot Saw	0	6
Shears, Knife	36	69
Shears, Rotary	9	27
Shears, Slitting	0	3
Nibbling Machines	0	15
Hammers, Steam	18	18
Hammers, Pneumatic (not portable)	3	3
Hammers, Drop	9	12
Hammers, Helve	12	21
Hammers, Spring	6	6
Riveting Machines, Pneumatic	0	6
Riveting Machines, Hydraulic	0	0
Riveting Machines, Steam	0	0
Riveting Machines, Power	6	12
Forging Machines, Hot, Bulldozers	3	12
Forging Machines, Hot, Forging Machines	9	12
Forging Machines, Cold Headers, Bolt, Nut, etc.	0	0
Forging Machines, Cold, Swaging	0	0
Bending Brakes	6	39
Bending Rolls, Horizontal	30	60
Bending Rolls, Vertical	0	0
Straightening Rolls	3	3
Punching Machines	33	54
Combined Punches and Shears	15	18
Presses, Hand, Arbor	87	195
Presses, Hand, Light Punch Press Work	0	6
Presses, Foot, Light Punch Press Work	3	6
Presses, Power, Crank Type	63	84
Presses, Power, Toggle Type	0	6
Presses, Power, Double-Acting Type	0	0
Presses, Power, Dieing Type	9	9
Presses, Power Automatic	0	0
Presses, Power, Trimming Presses	3	3
Presses, Power, Forcing, Arbor, Wheel	3	3
Presses, Power, Baling	0	0
Presses, Hydraulic, Bending, Forming, Drawing	0	3
Presses, Hydraulic, Forging	3	3
Presses, Hydraulic, Flanging	0	6
Presses, Hydraulic, Forcing, Wheel, etc.	24	30
Presses, Hydraulic, Baling	0	0
Presses, Hydraulic, Extruding	3	3
All other machines and miscellaneous	36	177
TOTAL	4,521	8,679

Conserving Labor in a Railroad Repair Shop

WHEN railroad repair shops are spread over several acres of ground, a practical system of handling materials is an economic necessity. The Oregon and Washington R.R., Albina, Ore., division of the Union Pacific System, has found gasoline tractors to be of incalculable advantage. Two types are used: a light, speed tractor, with a Ford motor, for quick service, and the Fordson tractor, with armored ends, shown in the headpiece and in Fig. 1, for heavy loads. The armored ends not only serve as protectors in ordinary service, but make bumping, and contact without couplings, feasible. Formerly cars in the yards were moved by man power, as shown in Fig. 2. Now the tractor, Fig. 1, does the work. Parts are transported between buildings, from and to the yards and machines, and in fact, wherever a tractor can go. The tractors are especially advantageous in hauling cars of sills, flooring, siding, and other parts from the lumber yard to the wood mill and from the mill to the repair or assembly tracks. Most of the tractors are arranged so that they may be coupled to and uncoupled from the trucks by the driver from his seat. All of the work referred to was once done by hand.

A portable electric crane is of great service in the roundhouse in the application of superheater headers and air pumps, as shown in Figs. 3 and 4. Two hitches are taken in lifting the superheater unit into place. By the first hitch it is lifted into the boiler, as illustrated. By the second hitch, made through the smoke-stack opening, it is lifted into its working position. Air pumps are lifted to working position in one hitch. The smokestack is another unit that is lifted into place in the roundhouse by the electric crane. A load of 3,000 lb. at a radius of 36 in. can be lifted by the 19-ft. boom of the crane.

For small parts, and for tools, the shop delivery push-wagon, Fig. 5, is kept in service. In connection with this service stores stations, Fig. 6, are maintained in the various departments. Requisitions are placed in the rack by the foreman and collected by the stores-department runner. Tools and valuable small parts, upon delivery, are placed in the compartments fitted with

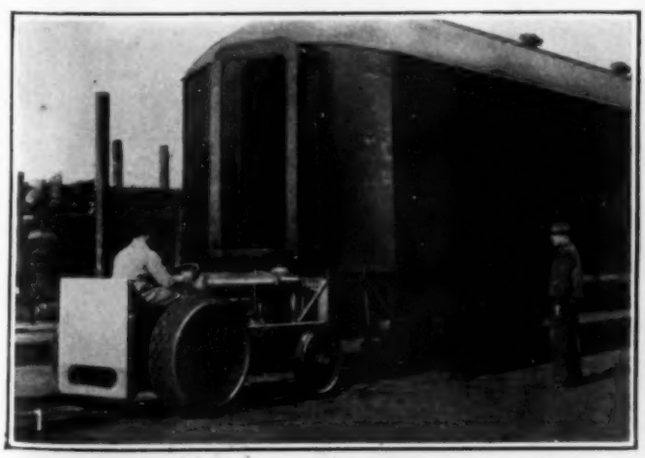


Fig. 1—Fordson tractor, with armored ends, moving car in yards. Fig. 2—Car formerly was moved by men

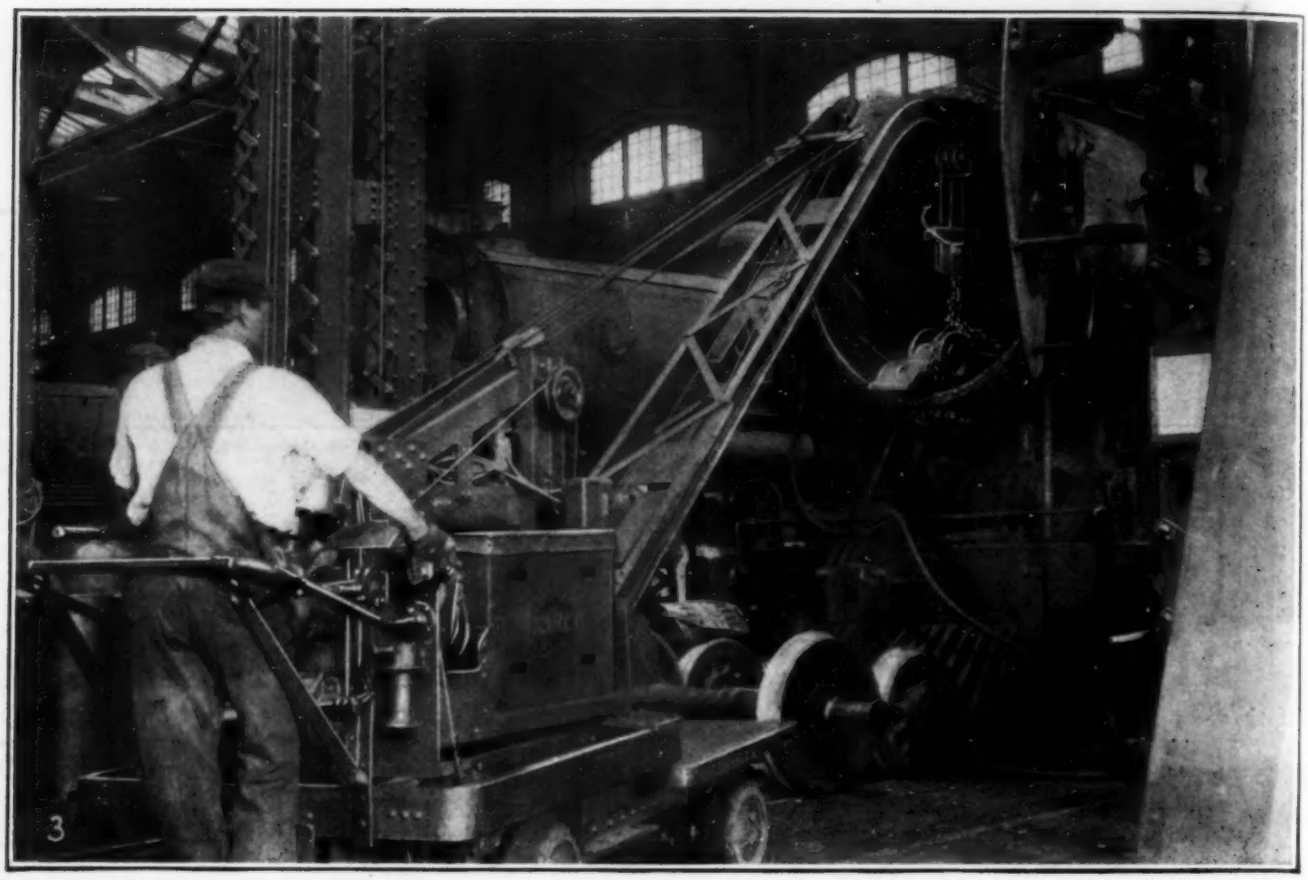
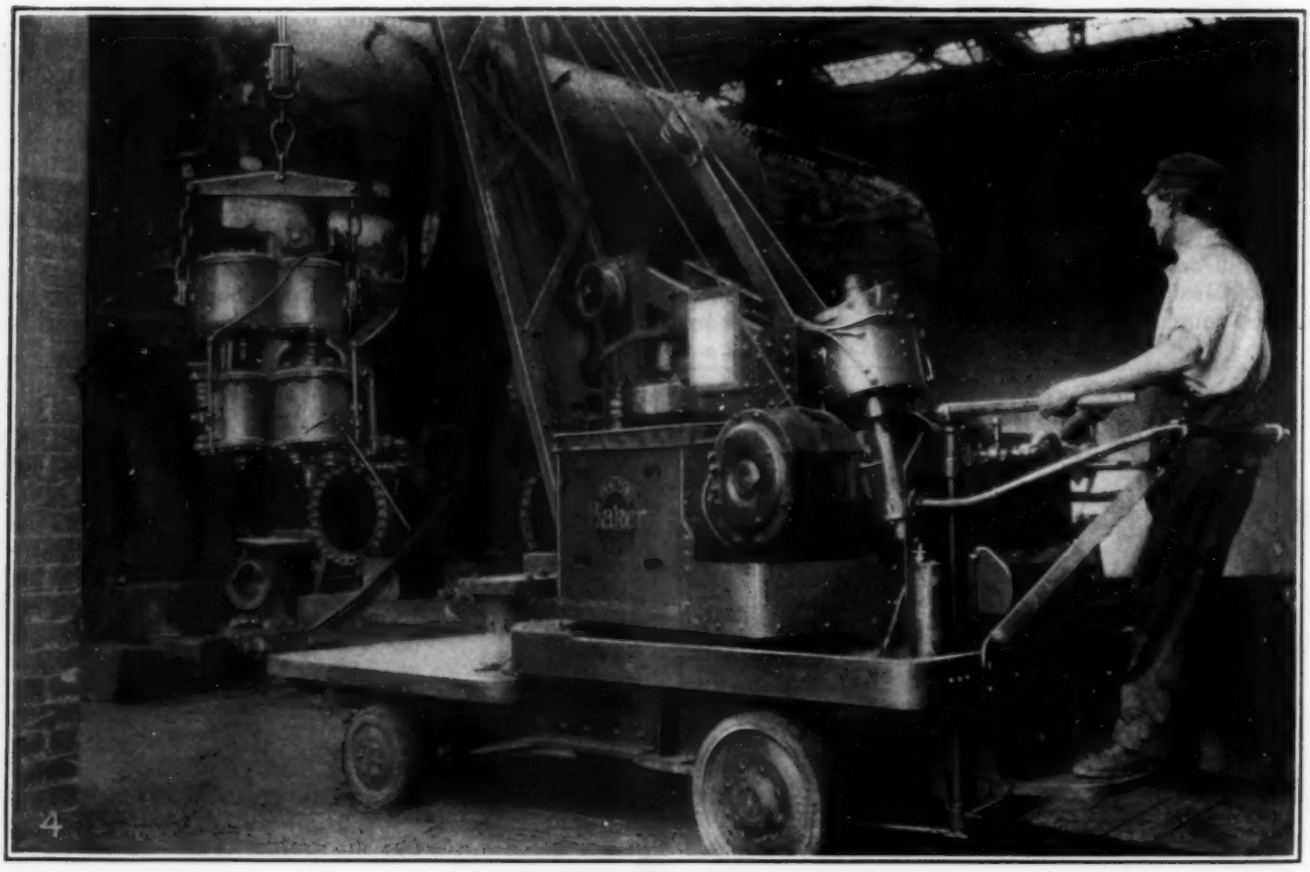


Fig. 3—Electric crane lifting superheater header to boiler

Fig. 4—Electric crane lifting air pumps to position on side of boiler



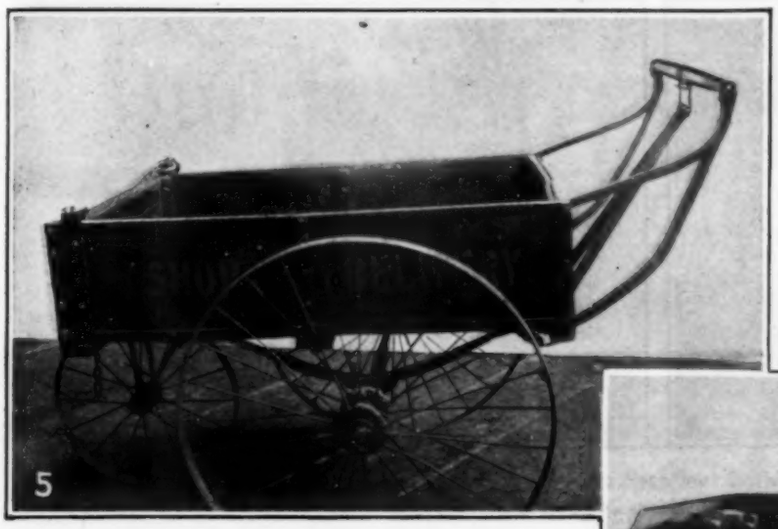


Fig. 5—Shop delivery push-wagon

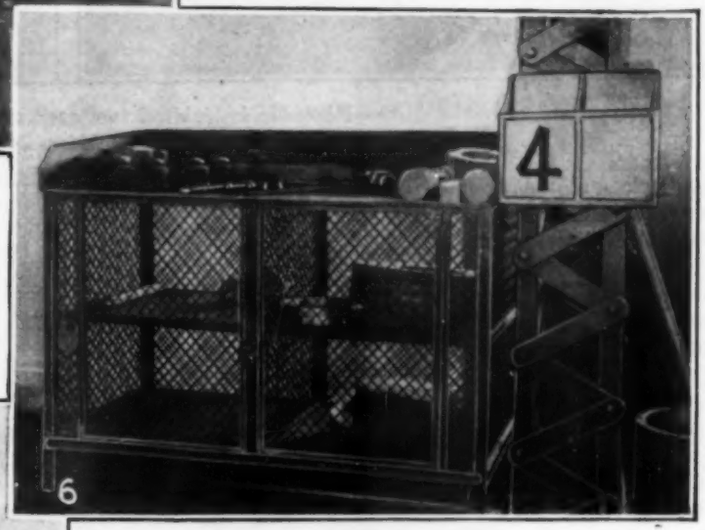


Fig. 6—Stores-station from which requisitions are collected and to which parts and tools are delivered by stores department runner. Serves also in interdepartment moving of parts

Fig. 7—Revolving tool rack

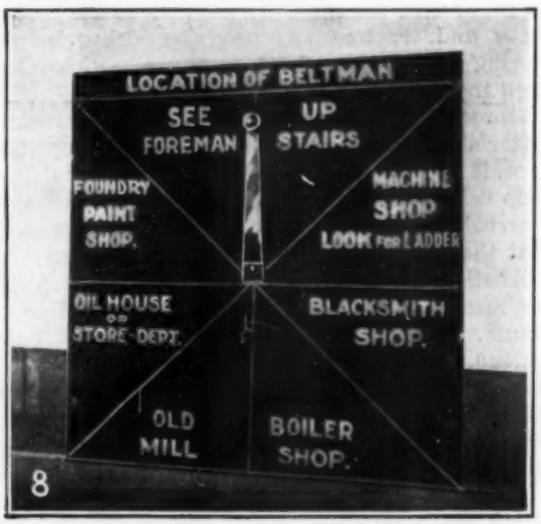
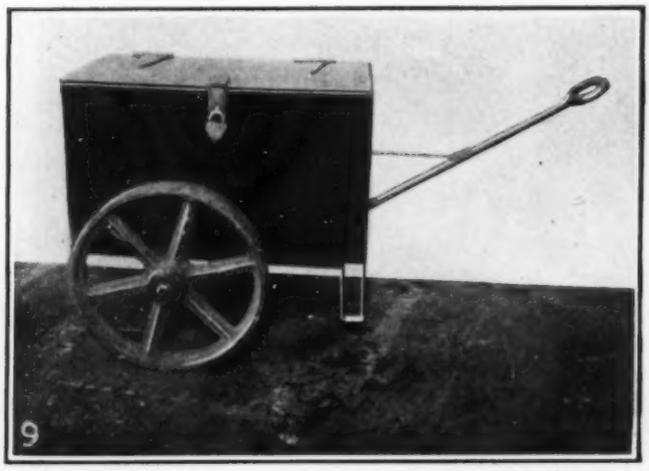


Fig. 8—Board to indicate location of beltman



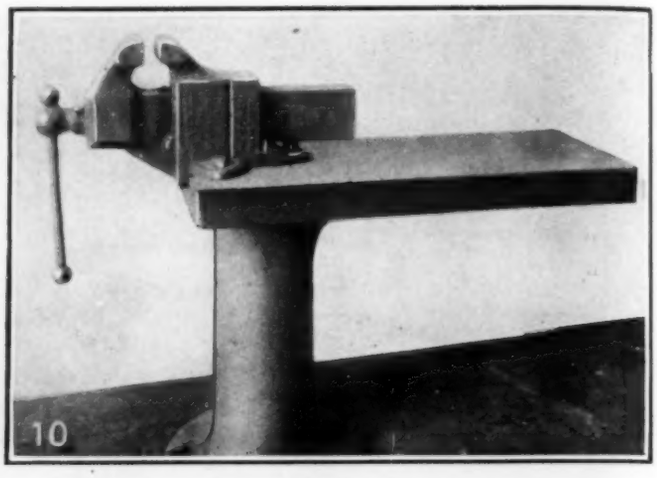


Fig. 9—Portable individual tool cart used by men on erecting floor.
Fig. 10—One of the vises located between pits

padlocks, and larger or less valuable parts are placed on top of the cage or on the floor near it. Keys are in the possession of the runner and the foremen only. By this system, the foremen and men, except in emergency, are not obliged to leave the floor of their departments to secure tools and parts. The stores runner collects the requisitions and delivers what they call for. Interdepartment deliveries are made at the same time by the runner, the move orders being placed in the racks and the materials in, on, or near the cage. In addition to the push-wagon, sacks and tractors are used for deliveries and for moving parts, the selection of the vehicle depending upon the weight or bulk of the objects.

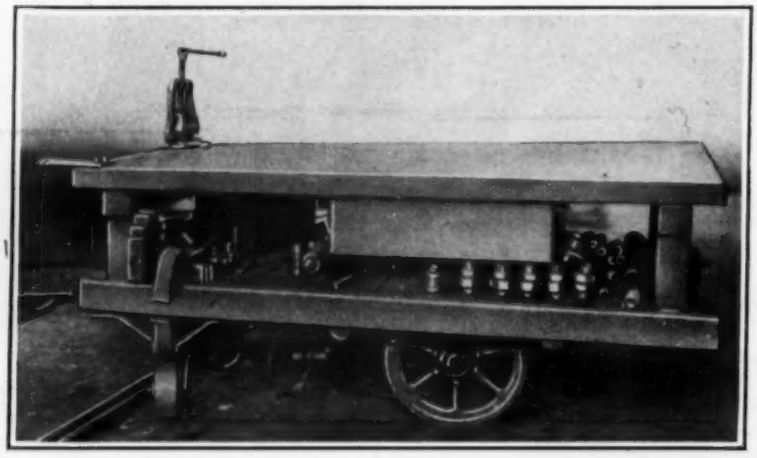


Fig. 11—Portable pipe bench for use of pipe gang on assembly

Moreover, there are phones in all departments. When material is needed in a hurry, and it is not advisable to wait for the runner to pick up the requisition, the shop delivery foreman is called on the phone and given a verbal order. The material is sent c.o.d., which means that the requisition is furnished on delivery.

Another mechanical device to conserve the time of the men is a red-light signal system used to call the cranes. Yelling and gesticulating are not necessary; instead, a switch is thrown to cause a red light, located on a column, to burn as a signal to the crane operator. When the crane service is over the switch is pulled. There are enough of the lights to designate definitely the job to be handled and to make signaling rapid.

Of the small tools, those most frequently used are kept in the revolving rack, Fig. 7. When the stores runner presents a requisition and a check only a few seconds are required for the exchange of the check for a tool and the delivery of the tool to the runner.

In keeping with the time-saving system and devices just described is the signal for location of beltman, Fig. 8. This signal is located near the office of the machine shop foreman, on the machine side of the shop, and about the center of the shop longitudinally. When the pointer is in the position in which it is shown in the illustration, it indicates that the beltman is at or very near his desk. When he leaves to go to any one of the other departments indicated on the board he sets the pointer accordingly. Because the machine shop is extensive, and there might be some difficulty in locating an individual in it, the tip is given on the board, "Look for Ladder." The same system is used in the pipefitting department to keep track of the plant pipefitter.

Portable Tools as Time-Savers

Time can be lost in running around by the men on the erecting side just as well as by those on the machine side. To prevent such lost time the men are provided with portable tool carts, Fig. 9, vises between pits, Fig. 10, and portable pipe benches, Fig. 11. There are also portable work benches, portable bolt lathes, and stationary, but conveniently located, small drilling machines. Another type of convenience is the platform built around the domes of each locomotive to facilitate work on top of the boiler and to reduce risk of accidents.

All of the work at the Albina shops is, of course, handled according to schedule. Record boards in the department carry the schedule dates, marked in white. When the work is completed according to schedule, that fact is recorded in blue. Completion dates ahead of schedule are recorded in green, and notation of delay is recorded in red. The data so entered on the boards are used as the basis for compilations to show the repair history of individual locomotives on specific shoppings. One man is charged with the duties of estimating schedule dates, keeping track of the progress of the work, checking the details of delays with foremen, and, finally, of preparing the repair history, or record of the various jobs.

Building Special Machines by Welding

By Robert E. Kinkead
Chief Engineer, Welder Division, The Lincoln Electric Co.

Single casting requirements for special machines run up the unit cost—Substituting built-up steel parts—How welding is applied to special machine construction

IN THE building of special machinery, where the patterns are used only once or at most a few times, welded-steel parts can cut costs in many cases. Standard steel shapes and plate are welded together to produce the required piece, and the assembling and welding are done directly from the drawing. Elimination of the patterns, which frequently cost five to ten times the cost of the first casting, is one of the important elements of saving.

Castings for special machinery are usually more expensive than standard production castings because the foundry has no opportunity to work out efficient production methods on such occasional jobs. Welded-steel construction requires special attention from the drafting room while it is being assembled for the first time, but the large differential in cost permits this supervision without consuming any substantial part of the savings effected. In shops organized for the work of building welded-steel construction, the welding foreman is able to go ahead with the assembly from the drawing without any greater amount of help from the drawing room than is required by the machine shop.

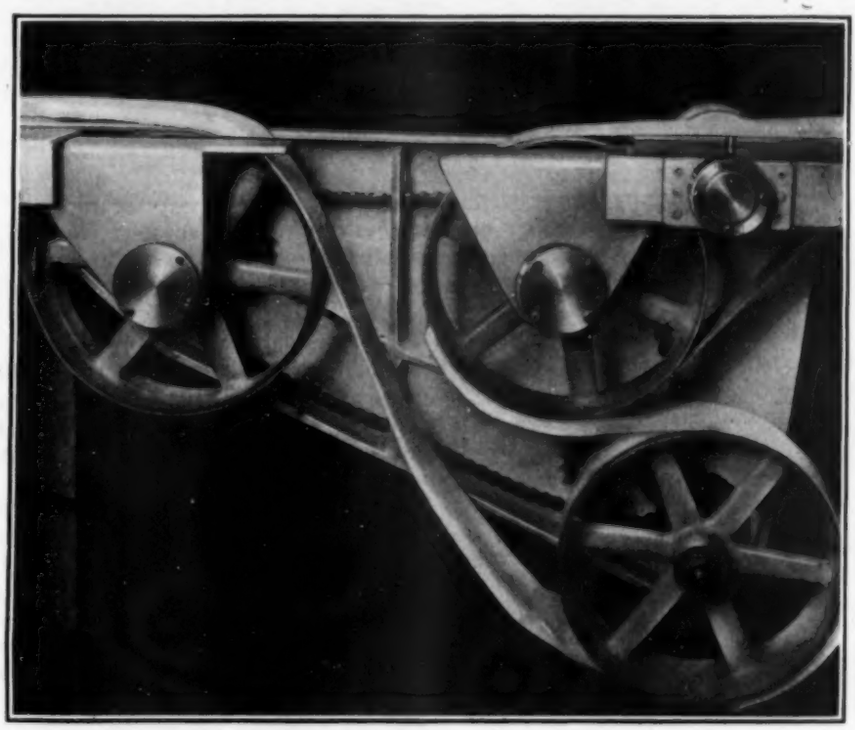


Fig. 1—A part for a special machine built up by welding

In general, the simpler pieces weighing more than 25 lb. can be made in welded-steel construction for less than half the cost of using patterns and castings. Small castings of complicated shape are, however, usually less expensive than welded steel. A small worm and gear box is an illustration of this kind. Such pieces have the gear case and bearing housing cast in one piece, and the whole gear case split in two parts. The job done in welded steel would cost more than the pattern and castings.

The determining factor in the problem of choosing between casting and welding lies in whether or not the piece can be built up of available shapes without excessive labor expended in forming. Experience with welded-steel construction tends to induce the designer to modify his design where possible to permit the use of standard steel sections welded together. The wide range of structural shapes, plates and tubes obtainable from and steel warehouse facilitates such modification in design. There is a considerable cost leeway in using welded steel in place of castings. Steel costs about 2c. per lb. as compared with a cost of 8c. to 10c. per lb. for special machinery castings. Less weight of steel is required because it is stronger and stiffer than cast iron. Where stiffness is a determining factor, only half the weight of steel is required, as compared with cast iron, steel being slightly more than twice as stiff for the same section. Thus the material cost of using steel is about one-eighth to one-tenth of the material cost of using cast iron for the same job. Where tensile strength is the determining

factor, steel has an even greater advantage because it is more than four times as strong in tension as cast iron.

Cost reduction is only one of the advantages of using welded steel in place of castings. Reduction of weight is often as important as reduction in cost. The superior physical properties of steel permit less weight in moving parts where reduction of inertia improves the speed of operation of the machine. High-speed automatic machinery has introduced the factor known as inertia of moving parts, and this factor frequently sets the final limit of output of the machine. Reduction of this inertia by the use of steel in place of cast iron, with the consequent reduction in weight, may affect in a large way the total cost of using a special machine, since it affects the maximum output per hour. Reduction of weight by the use of steel instead of cast iron also means a reduction of the costs of handling, transportation and installation.

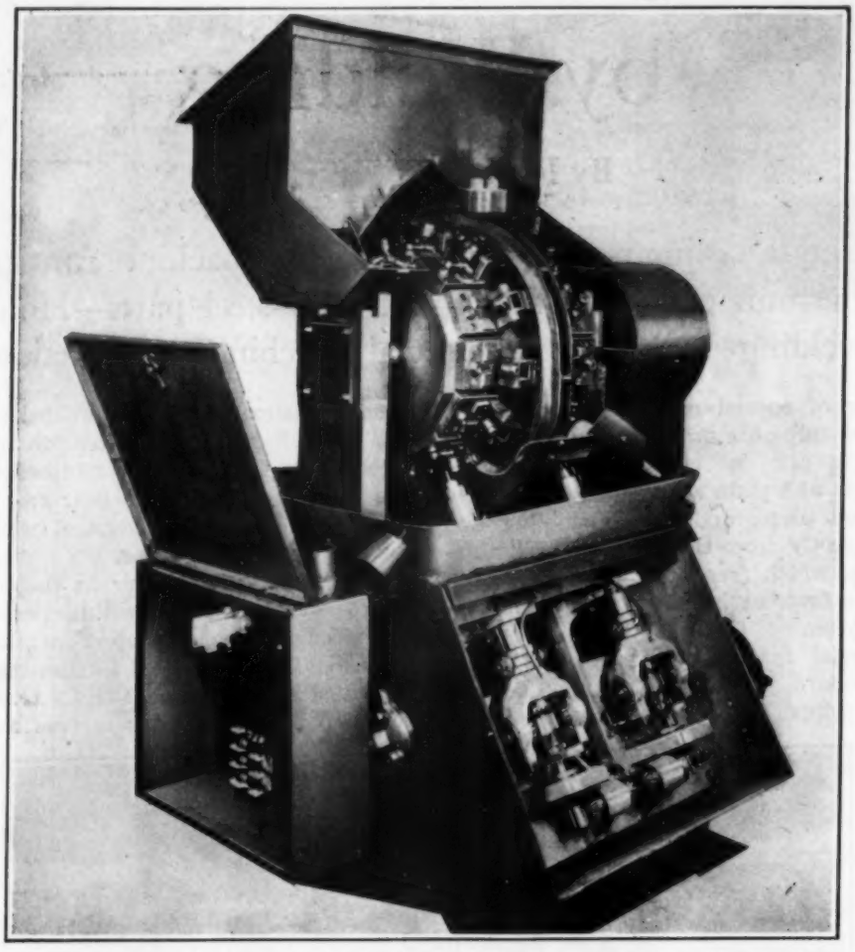


Fig. 2—A special automatic machine built up of welded steel parts. The frame, hopper, gear guard, and drum holding fixtures are of welded steel. The weight is 50 per cent less than cast-iron construction

In case of accidents to special machinery the welded steel parts will bend rather than break, while cast-iron parts often have to be replaced due to breakage. It is usually more trouble to get a new special machine part than it is to make a new pattern for it. The original patterns get lost or damaged in storage. Welded steel parts may be easily repaired or duplicated in any of the thousands of local welding shops of the country.

The wide field of usefulness of welded steel construction in place of castings, in the building of special machinery, is restricted only by the ability of designing engineers to apply the principles involved to definite jobs. In Fig. 1 is shown a section of a special machine in which castings have been replaced effectively by welded parts. The plate carrying the three pulley bearings is made of hot-rolled steel with flanges and ribs welded to it. The bearing housings are made of hot-rolled round bar bored to size.

The automatic tapping machine shown in Fig. 2 is an example of the application of welding to special machine construction. Expensive pattern making and casting have been entirely eliminated in the machine. The frame, base, hoppers, gear guards, and revolving drum holding fixtures are of welded steel. Still another example of a special machine built of welded parts is illustrated in Fig. 3. This automatic spot welder was built up from steel sections at a fraction of the cost of making patterns and casting the parts. Practically all of the large metal working industries of the country maintain elaborate tool rooms in which special machinery is frequently manufactured for plant use. These tool rooms usually have all of the facilities with which to manufacture welded-steel parts. Electric arc welding has become a shop process with which manufacturers who work metal are entirely familiar. Where the number of special machines to be built is so limited that the cost of patterns and castings will be a considerable item per unit, or where the reduction in weight of the machine parts is of importance, the matter of building up the parts by welding is well worth consideration.

Unlimited Field

The illustrations show the adaptation of welded steel to distinct types of special machinery, but in actual design practice the applications are unlimited. The number of machines required of the general type illustrated is necessarily limited by the enormous output of the machines themselves. Wherever this condition exists it is apparent that production methods of casting and machining castings cannot be applied economically, and consequently the field is open for constructions built up by welding.

The same principle holds for much of the repair work on production machinery in plants such as textile, paper, and sugar mills. Broken brackets can be rebuilt onto the machines, or housings and special units built up. This is especially true in the many factories where the production machinery has the nature of special machines, and repair parts cannot be obtained speedily. The con-

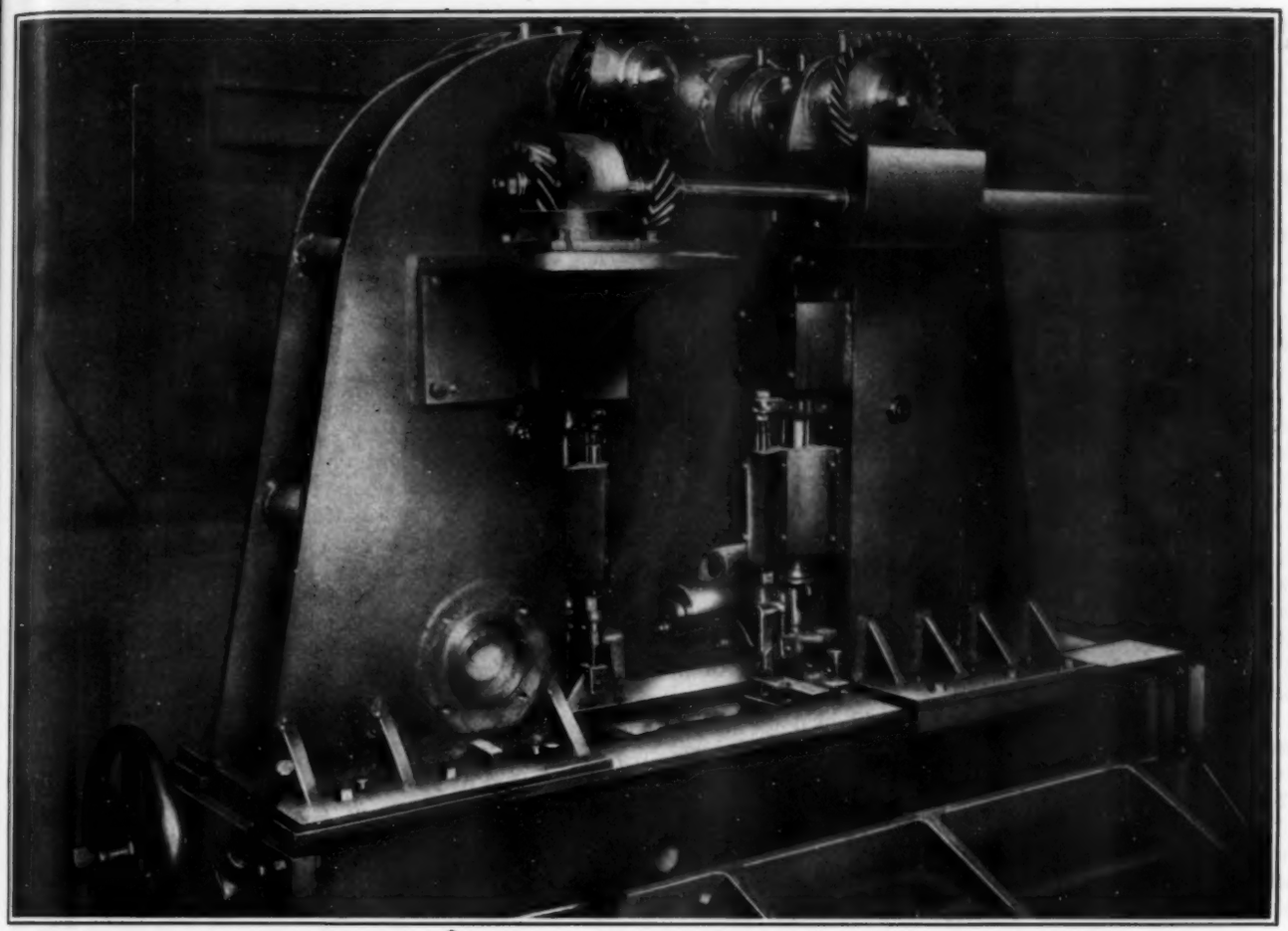


Fig. 3—A good example of welded steel to replace cast iron on a special machine where only a few castings are required, and where lightness is an added factor. Steel plate, built up by welding, is used throughout

structions built up by welding are usually of greater durability than the original pieces, and the process permits alterations in design to be made to compensate for the weaknesses developed in operation.

The economic need for the highly developed special machine that will eliminate hand labor is everywhere evident. The high cost of construction of such machinery has been the most important factor next to that of the engineering talent required to design it. The use of welded steel construction will reduce this cost item, and at the same time introduce strength and lightness, two desirable features in special machines.

Facts Concerning Babbitt Metal

By F. J. Wade

WHY should there be anything mysterious concerning babbitt metal?

It is true that its quality is hard to determine without its being put to a thorough practical test. For this reason there are many inferior grades of babbitt metal on the market.

Having and keeping in mind the service required of the bearing to which the metal is to be applied, should make the selection of a suitable babbitt metal comparatively easy.

I will endeavor to point out the cardinal points to bear in mind in selecting your babbitt:

They are Speed, Load and Lubrication.

Despite the fact that there are at the present time hundreds of various brands of babbitt metal on the market, there are in reality but two different classes of babbitt, and all the various brands come under one of these two classes: Lead base and tin base babbitt.

Originally the tin base babbitt was the only white bearing metal known, being designated as genuine babbitt. Later it was discovered that from an anti-friction standpoint, lead was the most desirable of all metals; from then on babbitt metal made its appearance carrying a greater or lesser lead content. Now we have a great number of brands in which the percentage of lead is greater than the percentage of all other metals.

Where the speed is great and the load on the bearing light, anti-friction, which means generally speaking a lead base babbitt, should be used. It will not heat as fast and requires less oil than other babbitt metal.

With conditions changed so as to babbitt a bearing that carries an excess load, where the bearing surface is small or where the bearing is subjected to a pound or knock, (such as connecting rod bearings) a tin base, or genuine babbitt should be used, because owing to the copper content most tin-base babbitt metal carries, it is tougher than lead-base babbitt and will stand more hard service.

Smashing the Nest Egg of the Golden Goose

By John R. Godfrey

"I WON'T be held up by anybody." 'Twas Jimmy Watson storming to old man Johnson about the nerve of a machine designer.

"What's the trouble, Jimmy?"

"Why that young squirt of a Jack Griffin wants to hold me up for attachments for that machine he built for me last year."

"Just what did he say, Jimmy?"

"Well, I told him what I wanted, and he said he could make them. And I guess he can—he's a real designer, all right. I hadn't said anything about price, but he did—the nervy cuss."

Johnson chuckled. "Just what did he say, Jimmy?"

"He asked me if I wanted to know what it would cost *now*—or wait until I got the bill. He said, 'You're going to have heart failure, anyhow, and if it kills you, it had better do it now before I get my money tied up in the job.'"

"And did you get realization or anticipation, Jimmy?"

"I dunno—but I got it plenty. Said he'd do it for two thousand dollars—cash on delivery. Pretty near floored me. Why I only paid three thousand for the whole machine last year."

"Yes, Jimmy—and that's why Jack charged you two thousand for those attachments. I happen to know he lost money on the machine last year—and largely because you were a piker, Jimmy. I hate to tell you—but you were."

"But Mr. Johnson, I had his contract—"

"I know, Jimmy—you were within the law. But you were a piker just the same. There's a lot of crooks out of jail because they know how to come plumb up against the law, but not to stumble over it. Jack told me all about it—and I haven't got over it yet.

Figured on Good Material

"Jack was a lot too enthusiastic I expect, when he guaranteed you sixty pieces an hour off that machine. But he figured on good, average castings. He didn't know you used such low-grade iron that it wouldn't stand a decent cut without springing all out of shape. You know he'd have made his guarantee first crack out of the box if you had used good castings. He got almost sixty pieces as it was. But you had to have the last piece of the contract, even though he was giving you nearly three times what you got before and twice what you expected, when you asked him to design it for you."

"But the contract, Mr. Johnson—"

"Yes, I know, you had the law on your side because he didn't specify the kind of castings, and so you forced him to spend a lot more than his normal profit to get the extra five pieces. And that's why he soaked you on the attachments. I think he was too low at that—I'd 'a' made you pay more than he did."

"Well, he'll learn to be more careful, I guess, Mr. Johnson—"

"Oh, he's learned already, Jimmy. And I've a notion to sue you for teaching him. I've been telling you for years that we'd be up against it if the tool-making shops couldn't earn a good living. Well, the time has 'came,' as the poets say. Jack has learned his lesson so darned well that he's quitting the game right now."

"Not quitting—going out of business, Mr. Johnson?"

"Yes and no—quitting so far as building special machines for dubs like us to make money out of while he takes all the grief and damned little profit, Jimmy. But not going out of business, because he's going to manufacture a staple article that will sell and sell right. He's learned all right, Jimmy."

"But who's going to build our special machines and tools, Mr. Johnson? We've got to have 'em if we're going to meet our competitors. Jack can't leave us like that, Mr. Johnson—it ain't fair!"

"But he can, Jimmy—and he has. And while I'm as much in the hole as you are, and more, I don't blame him a darned bit. Jack should worry whether *you* make money or not. Did you worry when he lost money on that job because of your rotten castings? You know what I've told you before, Jimmy. Unless these special tool shops can make a good living, we're out of luck. That's why I've fought shy of low bids from little fly-by-nights who wanted to do my work. I've always paid Jack what he asked, because I knew he was a clever designer and a good mechanic. But you've queered my source of supply as well as your own. Now don't come around to me bellyaching about Jack Griffin again. It's your own fault, and I hope it costs you a wad of money."—and Jimmy went out of the office.

"Guess that'll hold him a while, Godfrey. These pikers who make scads of money out of the machine the other chap builds, sort of give me a pain. Jack Griffin is a star at special work and we need him bad. Not only me, but all the manufacturers around these parts. And yet they not only won't let him make a decent living, but they hound him on every last detail. He's stood more grief and more abuse than any man I know around here.

"The truth is, Godfrey—most of us forget how much we depend on the men who supply us with our machine equipment. They work out a new design, get the most of the bugs out of it, and sell it to us at a comparatively small margin of profit. The machines turn out so much work that we only need a few of 'em—and makers can't distribute the cost over a large output as we do. They make one profit—and we go on earning dividends with the machine till it wears out or a better one comes along.

"Jack said to me the other day, 'Mr. Johnson, I've found the most money is in making a product by modern machinery methods—not in making the prime movers that make that product.' And I guess he's right. Perhaps some day we manufacturers will get sense enough to really encourage men with new ideas of machines—not drive 'em out of business by sticking for the last piece of a contract—when we know it isn't their fault."

It's like smashing the nest egg so that Old Golden Goose won't lay any more. Nobody can accuse Johnson of not seeing the other fellow's side in some things, anyhow.

Inventors should become familiar with the requirements necessary to secure a patent in other countries as well as in their own. This is particularly desirable because it is very easy to do some little thing regarding publicity that will prevent a patent being granted in other countries.

Automotive Production

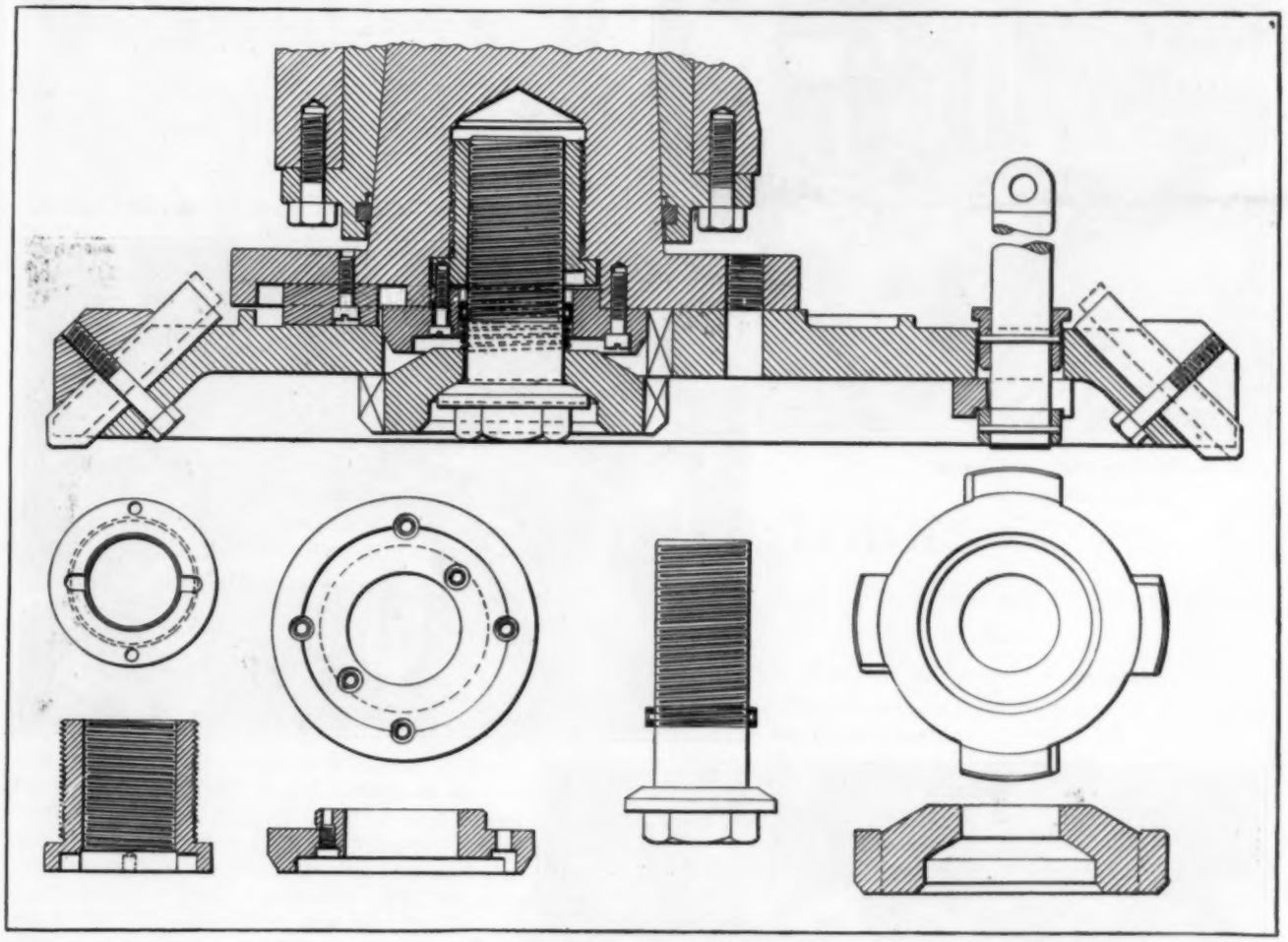


Fig. 7—Details of milling cutter

Machining the Morris Cylinder Block

By I. William Chubb
Editor European Edition, American Machinist

MANY points in the machine construction are worth attention, but only one or two are stated here. Each machine has two milling spindles and is driven by a 25-hp. motor. Unit construction being employed, all units can be taken off without disturbing the heads. Each unit is drilled and tapped for eyebolts, so that dismantling may be easy. In the design there is a complete absence of keys except on the driving motor, splines being used everywhere. The drive to the cutter spindle, which is 10 in. in diameter, is by double-helical gearing. All worms employed for the motions are hardened and ground and run with bronze wheels, except in the case of the table wheel, which is of cast iron. Lubrication for the various parts is abundant, 30 gal. of oil per min. being circulated by means of a 4-in. plunger pump. The base holds 170 gal. of oil. All feed shafts are covered with tubes so that the oil can be readily circulated, and the distribution pipes range from ¾ in. to 2 in. bore. The cut-

The second article. The third will appear in an early issue.

Automotive Production

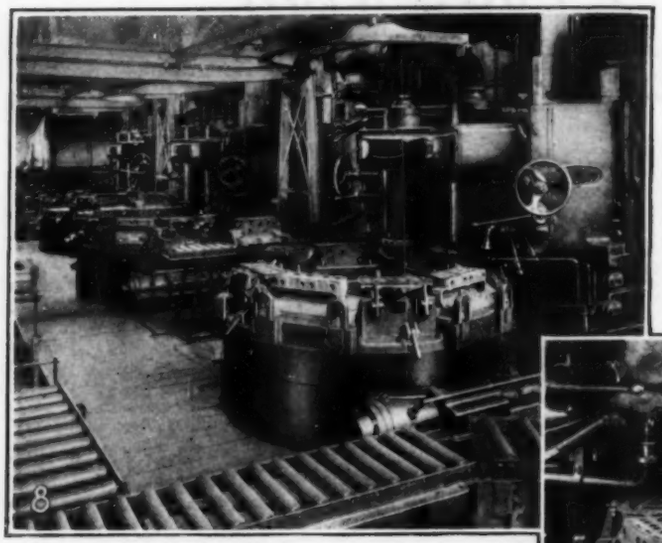


Fig. 8—Milling tops and heads of cylinders

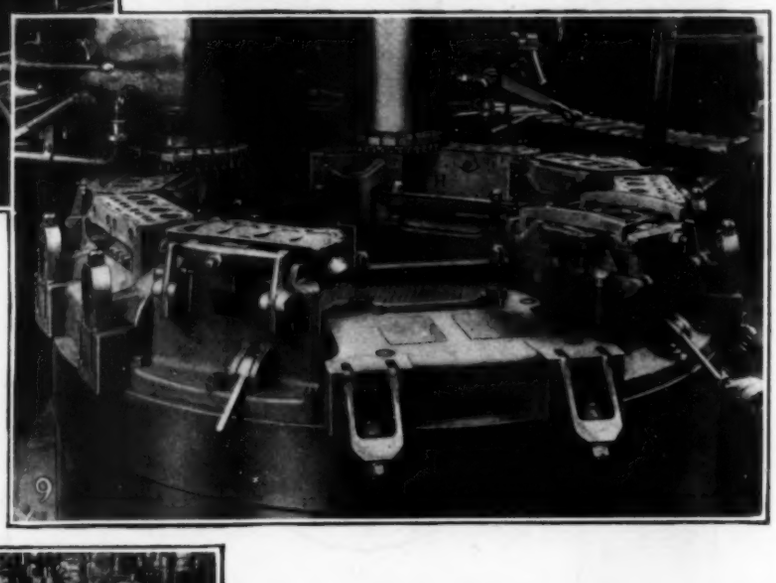


Fig. 9—Close-up view of cylinder milling

Fig. 10—Milling valve-cover face

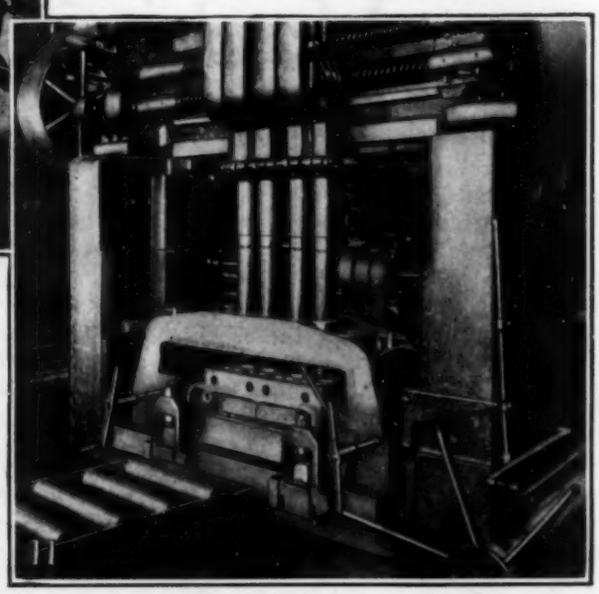


Fig. 11—Rough boring cylinders

Automotive Production

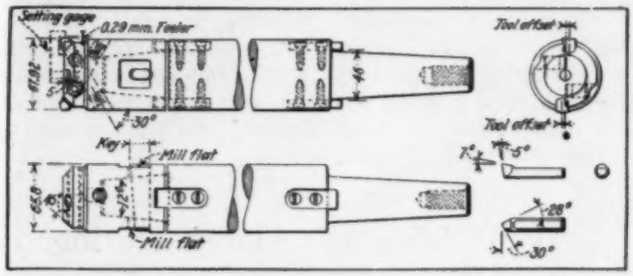


Fig. 12—Bar for rough boring

ter bodies are recessed on the top so as to catch any oil that may leak from the spindles and prevent it from escaping onto the cutting edges. The cutters are 24 in. in diameter. The feed given by the rotary table is about 3.35 in. per min., the cutting speed used being 54 ft. per min., though by change gears it is possible to get a range of feeds from 2 in. to 20 in. and of speeds between 35 ft. and 120 ft. per minute.

The type of cutter used in these and similar operations is shown in Fig. 7 and is standard. The body is of 0.5-point carbon steel and the high-speed steel tools employed are all of the same section, namely, $\frac{11}{16}$x$\frac{3}{4}$ in., and are interchangeable. They are clamped and interlocked at an inclination of 45 deg., as shown, a 16-in. or 19-in. cutter having 38 blades, a 24-in. 50, and a 30-in. cutter 60 blades. The drive is by two keys on a flange of the spindle, the cutter body having keyways 1 in. wide and $\frac{11}{16}$ in. deep. The body is placed on a spigot, and a clamp with four tangs is given a quarter turn against a stop fastened on the cutter body, which is then held in position by a central bolt.

Next, in a similar machine with the necessary fixtures secured to the table, the top face and also the face of the cylinder head are milled (Fig. 8) by means of two 16-in. cutters. For locating the head, a bridge gage having fingers that go inside the combustion chamber is used. The job is pushed onto locating strips, spring plungers holding it while it is gripped by a bridge, as indicated in Fig. 9. In the eighth operation (Fig. 10) the valve-cover face is milled in a horizontal Archdale manufacturing miller, the job being clamped on the under face and positioned by plugs through the arm holes.

For rough boring (see Fig. 11), the cylinders are located by plungers in the arm holes and are secured by swinging clamps. Between 2 and 3 mm. is usually taken out of each side of the bore, which is left at 67.92 mm. The tool is detailed in Fig. 12, the cutting speed being 29.5 ft. per min. and the feed 1.6 in. per min. The cutters are of 18 per cent tungsten steel. In the boring tool, the taper nose is held up by drift key and the tools are adjusted to a gage with a spigot on the end of the bar.

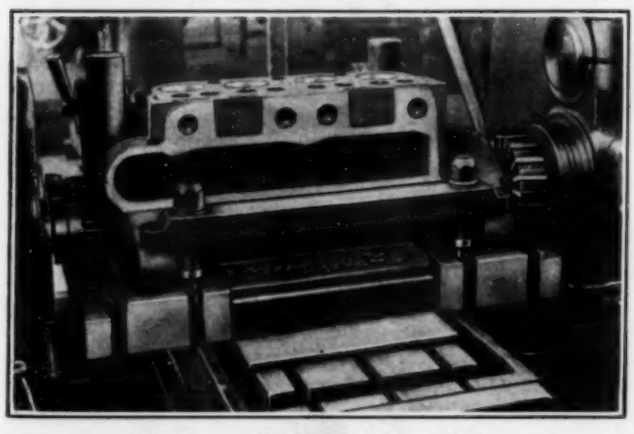


Fig. 13—Milling gear-box flange

After rough boring, the block is placed in a duplex milling machine where the gearbox flange is milled at the same time as the camshaft front-cover face and the water-joint face (see Fig. 13). End milling of the faces for the carburetor and the steering column, follows in a horizontal machine equipped with a two-spindle attachment. Milling the magneto platform and the accelerator face is performed on a 4B heavy Brown & Sharpe milling machine equipped with a two-spindle vertical attachment.

Abstracts

from other publications

Rolls-Royce Methods of Quality Production

All important components are forged with test pieces which are cut off and tested.

The heat-treatment shop is equipped for dealing with castings, including cylinder blocks and cylinder heads, which are annealed prior to machining.

It is fully realized that jigs or fixtures serve other purposes besides facilitating interchangeable manufacture. The main idea is to take into account the value of the component at the stage of manufacture which has been reached.

The final operation on the cylinder bores consists in lapping. A dummy piston complete with rings is reciprocated by means of a connecting rod which gives approximately the same stroke as that of the engine. To obviate errors due to side thrust, on account of the obliquity of the connecting rod, this is made of exceptional length.

The crankshaft webs are ground. Counterbalanced fixtures are used for finishing the bores of the connecting rods on Churchill internal grinding machines, and the center distance between the bores is held to a very close limit.

Rigorous methods of testing are adopted in addition to a close system of inspection throughout the factory. Engines and gear boxes are tested with a dynamometer in the usual way, in addition to which the entire transmission system is tested in a separate shop by anchoring the chassis so the road wheels rest on large rollers which are coupled up to a dynamometer. This gives the actual brake horsepower at the driving wheels.

For chassis which are to be fitted with closed bodies a test body is fitted. This body is secured by large hook bolts over the chassis channels, and has been designed to accentuate any slight noise that might otherwise pass unnoticed.—*The Automobile Engineer*, England, February, 1927.

Why Discard the V-Thread?—Discussion

By H. M. Darling

IN AN article by E. C. Herb, under the title given above, published on page 52, Vol. 66, of the *American Machinist*, the author tells of fitting a U.S.S. ¼-20 screw to a hole tapped with a V-thread, all of which would indicate that he is using some very poor taps and screws.

It is well to remember that the outside diameter of a tap has nothing to do with the fit, so long as it is large enough. Any increase over standard diameter simply gives clearance above the screw thread, which is desirable, and at the same time allows for wear of the tap, which is greater on the crest of the thread than on the angular parts. The pitch diameter is the vital dimension, and the usual commercial tolerance on ¼-20 taps is plus 0.0005 to plus 0.0025 on the pitch diameter.

When threading a close fit in cast iron, it is good practice to use soda water on the tap, which will cause it to cut close to size.

The quickest way to get an undersize tap is to place a standard tap in etching acid until it is cut down to the size required. After washing in hot soda water to neutralize the acid, it is well to sharpen the cutting edges by grinding through the flutes. This method will give a very satisfactory undersize tap for such jobs as Mr. Herb mentions.

Contests for Engineering Students—Discussion

By John F. Hardecker

I READ with a great deal of interest Prof. H. G. Thuesen's article on "Contests for Engineering Students" on page 174, Vol. 66, of the *American Machinist* and I am in hearty accord with his sentiments. I don't believe he underestimates the need one bit, and that with the present crying need of industry for practically educated men, a solution can be found any too soon.

I would emphasize that the contest should definitely train and bring out the student's ability to think quickly rather than his ability to dig out facts or his inclination to put in long hours at a given problem. I can recall that in my own student days at Cornell, each room of the Civil Engineering College had a large picture frame with the single word "Think" in it. I don't believe I thoroughly appreciated its significance then, but I have certainly done so since.

Therefore, rather than have these contests take some form of submission design such as the architectural contests. I believe they should rather be short oral questions, based solely on practical considerations, entirely devoid of reference to formulas or rules. They should check not the student's familiarity with academic theories and procedures, but his ability to do original thinking and do it quickly and immediately. This would tend to bring out his ability as an engineer based on the best definition I have ever encountered for one, namely—"An engineer is a man who can do for one dollar what any fool can do for two." The importance of time in engineering work is very great and the student who is successful in his studies merely because he devotes all of this time to his work has a sad awakening when he attempts to undertake his first job and discovers that his time is limited, and that his speed is a very definite measure of his success.

If he is ever to become an executive engineer rather than continue indefinitely as a mere detail engineer, then this training cannot begin too soon. The contests as suggested should form a very definite part of his training and help as much as any single factor to fit the student for his practical work. So I am in hearty accord with Prof. Thuesen's viewpoint.

Arc Welding as a Manufacturing Process—Discussion

By J. F. Lincoln

Vice-President, The Lincoln Electric Co.

ON PAGE 1057, Vol. 65, of the *American Machinist*, there is a very interesting article by A. G. Bissell, under the above title. It is gratifying to see that our large organizations are at last finding out the advantages of arc welding. I want to call attention, however, to the recommendation made as to the type of equipment to use where many operators are to be employed within a small area.

Mr. Bissell recommends in that case the use of a 60-volt flat-compound d.c. motor-generator set with suitable resistances for each operator. I doubt very much if he is fully conversant with the facts in making such a recommendation.

It hardly seems necessary to go further than to say that this is exactly the same type of equipment with which the first arc welding was done some forty years ago. I can't believe that since that time, there has been no progress made in arc welding, either in the manipulation of the arc or in the equipment for furnishing the current to the arc. It would seem unreasonable to believe that progress should be made in every other line of endeavor connected with electricity except arc welding.

The objection, of course, to this type of equipment is the fact that about two-thirds of all the power generated is wasted in resistance on the average; or putting the matter in figures, if a 1,000-amp. generator is used to its full capacity, it has an output of 60 kw. of which 40 kw. must be consumed in resistance in order to use the other 20 kw. in the arc.

There are a number of machines on the market that will entirely eliminate this loss and hence will be more economical. For example, let us assume that power costs 2 cents per kw.-hr. and that the machines are used at full load for six hours a day on the average. Then with the constant-voltage machine, the efficiency of which at full load would be 80 per cent, the cost of power would be $9 per day or in a year of 300 working days, $2,700. If, instead of this 1,000-amp. machine, five 200-amp. machines were used with the same amount of power consumed at the arc, or 20 kw., the cost of operation on a basis of 60 per cent efficiency would be $4 per day, or $1,200 per year. This case represents a saving of $1,500 per year. Not only that, but the five 200-amp. machines would be much more flexible and much more reliable.

I think it is safe to say that this constant-voltage apparatus will be eliminated from the market before very long, as no one can afford to use such apparatus in the face of present-day competition.

Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

Determination of the number of acceleration contactors—Dynamic braking—Types of protection offered on automatic controllers—Time- and current-limit acceleration contactors

AT TIMES it is desirable to control an adjustable-speed motor from a handle that is connected by shafts and gears to some form of master switch. The drum shown in Fig. 69, which combines both master switch and field rheostat, and which has a relay built into it to provide undervoltage protection, is frequently used for this purpose. The two lower contacts are used to control the reversing contactors of the automatic panel, while the upper contacts cut the resistance in and out of the field circuit of the motor. The resistors making up the field rheostat are mounted in the ventilated case on the back of the drum. The relay, which may be seen in the lower right-hand corner of the drum, is held closed mechanically when the drum is in its neutral position. When the handle is thrown to one operating position or the other, the armature of the relay is held in place by the magnet coil. Should voltage fail, the armature is released and the control circuit to the magnets of the automatic panel is opened. The relay may be reset only by returning the handle of the drum to its neutral position. Controllers for adjustable-speed motors having some means of strengthening the shunt field during the starting cycle, under ordinary conditions require only one armature accelerating contactor for motors up to and including 40 hp. Above this point two accelerating contactors should be sufficient up to at least 100 hp. Where vibrating field relays take the place of full-field starting contacts, one armature point may be satisfactory up to 10 hp., two to 25 hp., three to 50 hp. and four to 75 hp. Full-field relays also give protection to the motor in case the field rheostat circuit opens.

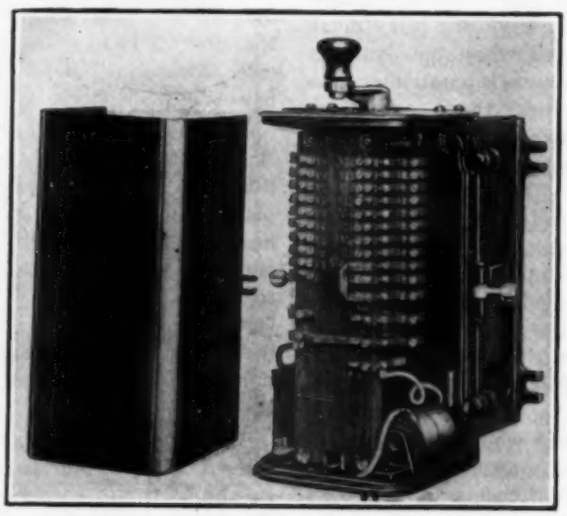


Fig. 69—Drum Controller for use with an adjustable-speed d.c. motor

On controllers used for constant-speed d.c. motors, the number of accelerating contactors should be determined to a certain extent by the speed of the motor. For standardization purposes, the controllers must be built so that they are satisfactory for use on a 1,750-r.p.m. motor, with the result that they may have more contactors than are necessary for a motor of lower speed. One accelerating contactor is sufficient up to and including 3 hp., two from 5 to 40 hp. inclusive, and three from 50 to 150 hp. These cover all the motors usually installed on production machinery.

The above number of accelerating contactors is sufficient for all ordinary purposes. Where unusual smoothness of acceleration is necessary for any reason, additional contactors may be employed. Usually, however, the above number of accelerating points, particularly if the time of closing of the contactors is properly adjusted, will give all the smoothness in starting that is necessary.

Dynamic braking is secured by connecting a resistor across the terminals of the armature after the armature leads have been disconnected from the line, the shunt field still being energized. The motor acts as a generator, and the power generated is dissipated in the resistor. In this way the kinetic energy of the rotating armature is transformed to heat energy, and the motor is brought to a stop. The rate of deceleration may be adjusted by changing the amount of the resistance, as the higher the ohmage of this resistor, the slower is the rate of deceleration. A motor may not be stopped too rapidly in this manner, as the maximum current and consequently the maximum rate of deceleration is fixed by the current that the commutator will carry without injurious sparking. Usually in the case of machine tools the standard controllers brake a motor too rapidly rather than not rapidly enough. Should a motor be stopped too suddenly, severe strains are set up in the gearing and other machine members, resulting in broken gear teeth, distorted shafts, and excessive wear of gear teeth and bearings. It is believed that standard controllers should be built with a larger amount of dynamic-braking resistance than is customary, so that a motor will take three to four seconds to come to rest

The eighth article. The ninth will appear in an early issue.

from its maximum speed, and provision should be made for decreasing this resistance if desirable.

The connections for dynamic braking are made either by contacts on the bottom of the line contactors as in Figs. 63, 64, 65, and 68, which close when the line contactor opens to disconnect the motor from the line, or as in Fig. 67 by a separate contactor, mechanically interlocked with the line contactors, that is closed by

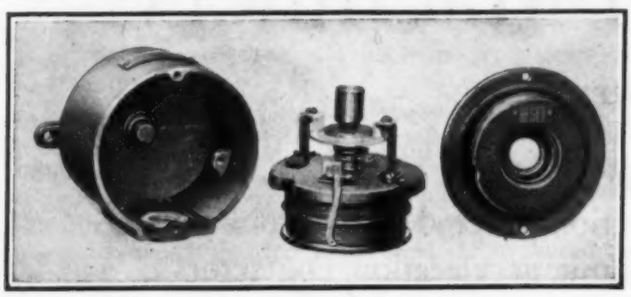


Fig. 70—Push button incorporating undervoltage protection

the voltage generated by the motor armature while it is coasting. The first method is simpler, but if it be used, a coil should be provided to hold the lower contact closed while current is flowing, or preferably, to pull the contactor open as soon as the upper actuating coil is de-energized. Such coils on the lower part of a contactor prevent a motor from being restarted or reversed until the motor has first come to a stop.

The desirability of undervoltage protection has been previously indicated. All modern automatic controllers include undervoltage protection when used with a three-wire master switch, such as the familiar "start" and "stop" push button, in which the controller is started by a momentary depression of one button and stopped by a similar depression of a second button. Where drum master switches are used, an auxiliary relay must be used, that may only be restored when the drum is in the neutral position. All automatic controllers do not give undervoltage protection under these conditions, and consequently care should be taken to choose an automatic panel that gives adequate protection when used with the desired master switch. Any automatic controller not providing undervoltage protection gives undervoltage release. Consequently it is imperative to prevent these terms from being confused. Where it is not practicable to provide undervoltage protection by the use of three-wire master switch, a special push button is available, which is shown in Fig. 70. This button is provided with a coil which, after the button is manually depressed, holds it in this position until voltage fails. The coil may either be shunt wound, and provide true undervoltage protection, or it may be series wound and connected in the shunt field circuit. In this case it not only provides undervoltage portection, but also protects against accidental opening of the field circuit.

Automatic controllers, when any overhead provision is made, have overload protection. This may be given by fuses, by a plunger relay with a series coil, or by a thermal relay. The tendency at present is to use thermal relays on all equipment except that for motors of large horsepower.

Automatic controllers seldom provide for decreasing speeds by introducing series resistors into the armature circuit. On wheel-lathe control equipment, such as shown in Fig. 71, provision is made for momentarily inserting resistance in the armature and short-circuiting all field resistance that may be in circuit, should there be a hard spot in the wheel, by pressing a button. Planer controllers are frequently arranged so that a slow speed for setting up the work is obtained by running with the field rheostat short-circuited and a resistor in the armature circuit.

When automatic controllers are used with field-weakening, adjustable-speed motors, good practice demands some provision for short-circuiting the field rheostat during the starting period. Motors having a speed range of 1½ to 1 or even 2 to 1 may do without this provision, but its omission is never desirable. For larger speed ranges, such provision is very necessary. In cases where the motor obtains its speed range by shifting the armature axially, or by some similar method, the field is always operated at its maximum current strength and consequently no full-field contact or relay can be used to advantage.

Occasionally a controller is arranged so that the armature may be shunted by a resistor. This use is rare inasmuch as the shunted resistor has no value except with a series or heavily compounded motor. The most usual use is on the hoist motor of a crane, to reduce the lowering speed. Some driving-wheel lathe controllers also shunt the armature when the motor is slowed down to pass a hard spot in the wheel. It is believed that this application is of little value, and the shunting of the armature for this service is not a general practice.

Field rheostats may be obtained in which resistance may be cut into or out of a field circuit by pressing on a push button some distance from the rheostat. There are two types, one actuated by a small motor, the other by magnets. Both, as designed at present, are too large and too expensive for use on the ordinary machine tool, but it is believed that there would be a field for the use of such rheostats if they could be made in a size more suitable for motors ranging from 20 to 50 horsepower.

Frequently motors are provided with special windings that are in circuit only part of the time. Planer motors illustrate this construction particularly well. Some planer motors have special series fields while others have special interpoles that are in circuit to improve starting conditions and are short-circuited when the motor comes up to speed. Other planer motors have special series fields that are energized only after the circuit breaker has tripped for any reason, to complete a special dynamic-braking circuit and so prevent overtravel of the planer table.

When a motor is started with resistance in series to reduce the starting current, means are usually provided to short-circuit this resistance in one or more steps. There are several means of timing these accelerating contactors. In the first type, the contactor is closed after a definite time, which may or may not be adjustable. In the simplest type, the magnet coil of the first accelerating contactor is energized as soon as the line contactor is closed, that of the second accelerating contactor as soon as the first is closed, and so on. On some controllers a plunger is pulled up by a magnet coil and retarded by a dash pot. As the plunger pulls up, it short-circuits successively the various sections of the starting resistor. The period of acceleration may be varied by adjusting a valve in the dash pot.

Time-limit acceleration has its value, particularly in the case of mine fans, pumps operated through a float switch, and similar applications, where it is more important to start the motor at any cost than to protect it. It has been used satisfactorily on some single-purpose controllers, such as those for reversing motor planers, but it is felt that some type of control that gives better protection is advisable for machine tools. If a machine tool equipped with a motor of the proper horsepower will not start up, trouble is indicated. The usual causes are hot journals or excessive starting loads caused by attempting to start the driving motor with the cutting tool buried in the work.

Current-limit acceleration provides for cutting out a part or all of the starting resistor when the current drops to a predetermined value. This method is very good from the customer's standpoint, although it means greater diversity of parts for the controller manufacturer to carry in stock.

Counter-emf. acceleration provides for cutting out the armature resistance after the motor speed has reached a given value. This method is simple and reliable and is extensively used. The magnet coil of the accelerating contactor is connected in parallel with the motor armature and as the motor comes up to speed, the voltage across the armature increases until it becomes sufficient to close the contactor.

There are various special relays, actuated by the voltage drop across the starting resistor or by other methods that provide for closing accelerating contactors

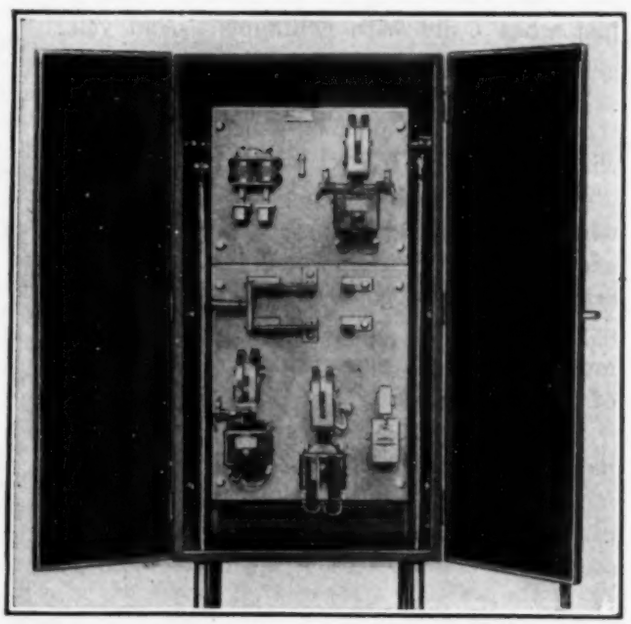


Fig. 71—Controller for 50-hp. wheel-lathe motor

when conditions in the motor have reached some predetermined value. These are usually good in themselves, but have the disadvantage of requiring another piece of equipment, which may give trouble and which must be maintained.

Controllers are occasionally built to prevent one motor from operating in a certain way until conditions in another motor are satisfactory. One equipment of this sort prevents the starting of the feed motor until the driving motor has come to speed, and in case of an overload on the driving motor, decreases the speed of the feed motor to its lowest or full-field value. Equipments of this sort are usually special and should be designed to suit the requirements of the work.

At times it may be necessary to synchronize the speeds of several motors. This is done in the case of a paper mill by a very ingenious equipment, which, however, is very elaborate and too expensive for ordinary applications.

Semi-magnetic controllers usually are the same as the full automatic controllers, except that the motor line and dynamic-braking connections are made by a drum instead of by contactors. Such a controller is not desirable in sizes larger than 25 hp. 230 volts, direct current. It is felt that the line current may be handled to much better advantage by a contactor equipped with properly designed blow-out coils and arc chutes than by a drum. Such a controller is usually little cheaper than the full-magnetic controller, because of the cost of the drum controller, and it is not possible to control such a panel by a push button either auxiliary to a combined drum master switch and field rheostat, or by itself.

The Problem of Tin

By G. B. Stuart

DISTURBING reports from the tin industry of the failure of supplies to keep up with consumption may not be as serious to the mechanical industry when viewed in the light of all the factors. But certainly the reports are bad enough. All surplus stocks have been consumed, and in spite of improved machinery the production in 1926 dropped below that of 1925, although consumption demands increased. The price per pound soared during the year to 72 cents.

Although the United States consumes more than two-thirds of the world's tin production, little is produced here. London has been the center of the tin trade, and figures indicate a wide range between production costs and selling price. Production profits have also been high, and it is reported that the Dutch Government last year realized net profits equal to three times the total capitalization of its tin mines at Banca.

Tin has become a rare metal. Its chief uses are as a coating for other metals, and for the making of brass, solder and babbitt alloys. In certain uses it is considered indispensable. But fortunately, in tin plate and in solder, where nearly 60 per cent of the tin consumption goes, the cost of the tin used is usually small compared with the total manufacturing cost of the article. Unquestionably, the use of terne plate, zinc plate, and galvanizing can help to bridge the gap and prevent too abnormal increases in tin prices. Aluminum foil and lead foil have already largely taken the place of tin foil.

There is no substitute for tin in bronze and brass, but only 6 per cent of the consumption goes for this use. Babbitts and bearing metals take more than 14 per cent of the total tin consumption, and would offer a more serious problem to the mechanical industries. But here, too, are enough substitutes to react effectively against high prices. Tinning operations in manufacturing are numerous, but less than 3 per cent of the total tin consumed goes into such work, and substitutes such as sherardizing and cadmium plating have been appearing with regularity. In general manufacturing, therefore, a prospective tin shortage should not cause undue uneasiness.

THE · FOREMAN'S · ROUND · TABLE

Do We Buy Labor or Production

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SAY, Al, a friend of mine says you're all wrong about advancing a man's pay before he kicks for it."

"What's this all about, Ed?"

"Why, I was just telling him how you handled Schimmel. I thought it was a good job but he said we were both wrong. His idea is that it's a foreman's job to get men for as little as possible just as the 'P.A.' has to buy metal at the lowest price."

"Sounds like a back number to me, Ed. We don't buy production or productive capacity. If every man's work was of the same value, your friend might be right. But if he's right, then a lot of the big men are wrong. Just what did he say, Ed?"

"Said you evidently wanted to play Santa Claus with the firm's money and stand in with the men. He asked, sort of sarcastic like, if you'd pay a man ten dollars for an eight dollar pair of shoes."

"I know a lot of birds like him, Ed. But they don't get on very fast. No one ever accused Henry Ford of playing Santa Claus —and Henry never pretends to be. But he has raised his wage standard above the average twice—and he's cut his production cost by doing it.

"I wouldn't pay ten dollars for an eight dollar pair of shoes, if I knew it. But I'd gladly offer a man ten dollars to make me a pair that was worth eleven dollars. That's just what I did with Schimmel. And you know how well that has paid the company.

"Here's one thing to remember, Ed, though there are a lot of general managers who overlook it. It isn't wages that count—it's what the machines cost to produce. Our whole automobile industry is a shining example of what high wages can do in lowering production costs. No other country pays over half of our wages and their automobiles cost a lot more than ours do in spite of our high wages."

"You're right, Al. Wait till I see that back-number bird again. His own shop isn't any too prosperous—perhaps his idea of buying cheap labor is the reason."

Is Al's answer to Ed's friend's criticism sound?
Do we buy labor or production?
Or do low wages and low costs go together?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Making Good Workmen Out of Poor Prospects

THERE are very few men who are poor prospects in every sense of the word and in every condition or field and, as Al says, if the foreman is lucky enough to catch the flash when a poor prospect makes the right contact, so much the better for both. Machinists are like books, they cannot be judged by their covers.

A man once worked in a general engineering shop on one of the larger machines. He was dirty, unwashed, unshaven, his hair uncombed and he was absolutely indifferent to the slurs and knocks of the other men about his appearance. When he occasionally did a poor job you might as well have talked to the machine as to jack him up for it. Everything you said went right over his head. But when there was a really tiresome job that required endless patience that man was the best one in the shop for it. Another man in the same shop was the model of cleanliness. He spent so much time wiping his hands and tools that he failed to do any work. He did not last long on the big machines but was a fairly good man on reproduction work where oils were not used for cutting. For some reason or other the operators of big machines seem unable to keep up their appearance as well as those working in the toolroom or on light machines. Often the best mechanics are chronic grouches. While this makes them hard for the foreman to handle it is a good thing in many ways. This man will be indifferent to public opinion as to his methods and quantity of work. He does not care whether the men next him do growl because he turns out more work. —PHIL AIDA.

IN THE case given it is my opinion that Al acted in the best way possible. Apparently Schimmel was a negative sort of individual who had managed to get a bad name simply because he possessed neither the will nor the self respect to make good. There are many such people in the shop. If they are well looked after and chased up over their work, which must be something as definite as possible and without pitfalls, they develop into very efficient producers.

Supposing that you find a man of this type in your department, he will be a distinct asset. There are many little jobs which must be done properly and which are often skimped just because they are little. Put a good man on them and he will rush and turn out an indifferent product. Put the special type to work and all will be well. If he shows that he is a willing worker pay him a fair wage and do not wait until he asks for it. Some day he will realize just how useful he is and there will be trouble.

It does not pay to spend weeks in developing a backward fellow but neither does it take that time to sum him up. If he is worth while then help him all you can. If he is not interested enough to try then make room for someone more useful. —A. L. WALKER, *England.*

Cutting Down Spoiled Work

GAGES do not wear down suddenly and if Ed works in a shop where quality is the first rule, all gages would have to go through a periodical comparison with the master gages. The inspection department should be absolutely impersonal. Personal grudges must not enter into the execution of its duties. If the part to be scrapped is very expensive and the defect is such as not to lower the standard of the product, the inspector should take the matter up with the engineering department. The engineers are responsible for the quality and quantity as well. Only too often one finds that the inspectors are greatly influenced by the production department which is mainly interested in getting the work out on time. I know one firm where all the spoiled work is thrown into toteboxes which are emptied once a week. Incidentally this spoiled work is separated as to materials. A sign hangs over each box with the legend, "This week's spoiled work is valued at $——." (The amount is changed every Monday.) "It will pay you to help us reduce it." The amount of spoiled work charged to each individual is recorded in the office and is referred to when the question of an increase in pay arises.

—MORTON W. WALTERS, *Designing Engineer.*

OCCASIONALLY gages wear beyond the limits but with an efficient gage department the number of times would be very few. To blame worn tools or machine is all well and good but that is what gages are for —to show when a piece of work is being imperfectly made. If every few pieces of work are gaged there should be no cause for defective work to pile up.

The idea of scientific management is to offer incentives to the employee to do better work. One theory is to show him what his fellow workers are doing and the amount of rejected work each has, but this is only theory; it has worked in some plants but for the greater number of concerns it has not been much of a success, especially where the employees are of the so-called floating type.

Labelling the work with the man's name is likely to do more harm than good because the man sees the amount of work another has spoiled and comes to the conclusion that if one man can have a large amount of

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THE · NEXT · TOPIC

Mutual Aid Societies

QUESTIONS

Men get sick and need help at times. How can it be given best?

Is there any better way than Mutual Aids in the shop?

spoiled work and not be fired he can get away with it too. It is better to keep a record of the rejections and the men responsible. When the spoiled work that a man does is very high he should be spoken to about it. If he still keeps making rejected pieces the only thing that can be done is to discharge him.

—B. C. THOMAS.

BONUS penalties are a good means of checking carelessness but I do not agree that the whole group should suffer for the carelessness of a few individuals. In my department we work on the straight piecework plan and my method of stopping carelessness is to deduct part of the balance due to the man whose pure carelessness has spoiled some of the work. In case a man is continually careless it is best in the interest of the man and the firm to discharge him.

—C. L. HENRY, *England.*

THE spoiled work problem can best be presented to the employees by making them acquainted with the loss that is involved in each case. For illustration, five brackets were spoiled during the third operation. A card was made out and placed on the spoiled work showing the value of one of the brackets at the various stages of progress followed by an explanation of the cause.

Cost of the casting as delivered to the shop...	$1.73
Cost of the first milling operation.....	.94
Cost of the second milling operation.....	.72
Cost of the third boring operation.....	1.10
Total.....	$4.49
Cost of the five spoiled brackets.....	$22.45

These brackets were found to have been bored out of alignment with the base because the boring fixture was set up on the machine without properly cleaning the base of the fixture and the table of the machine tool. Chips were found under one end of the fixture when it was removed from the machine. These chips had fallen unnoticed and cost $22.45 in spoiled work.

The name of the man should not be placed on the exhibit. The spoiled work can be discussed with him privately and the circumstances surrounding each case will always determine the action to be taken with the man.

—JOHN MARK MAY.

WITHOUT a shadow of doubt the question of reducing losses arising from spoiled work is about as far-reaching a problem as any that confronts industry today. There are three main factors which, in a varying degree, are responsible for most spoilage. These are the materials, the equipment and the employee. To these might be added a fourth, the method.

Instead of merely passing the buck onto outside elements such as gages, or fancied grudges on the part of inspectors, let Ed find out just what his scrap consists of, how much of it is conceivably chargeable to defective gages, how much is due to inaccurate handling in the production operations, and even how much, if any, might have been called defective by the inspection department when actually it was perfectly useable. A part, at least, of the spoiled work is usually due to causes out of the control of the operator.

There is no question but what a visual exhibition of spoiled work would be of benefit, especially if carefully tagged with cost values. There must be no direct charge laid at the door of any individual for each man who looks over an exhibition of spoiled work will carry away with him a very definite picture of his part in the exhibit of spoiled work.

—D. C. WRIGHT.

THE foreman who would accuse the inspection department of rejecting work from his department just because they had it in for his men, has a very hazy idea of interdepartmental co-operation. Furthermore, if work passes his gages and is rejected by the inspection department he only further demonstrates his own restricted vision when he lays the blames somewhere else and fails to attempt to find the difficulty.

The exhibit of spoiled work might prove of value to a number of departments. A piece spoiled because the working gage was worn beyond the limit would carry no weight with the machine operator, but it would be a lesson to the tool inspection department. Spoiled work from lack of rigidity or inadequate clamping means in the fixture might be viewed with interest by the tool design department. Wrong gage or wrong use of the gage would, of course, be up to the foreman or to the operator. It would be a mistake to put the name of the operator on a spoiled work exhibit since it might not have been his fault and it is a sort of personal matter anyway.

—H. B. SCHELL.

More About Discipline in the Shop

AL'S plan would seem to work in most cases. However, the writer has tried it before in one instance and it failed. Here is a narrative of the instance.

"Jack, report to Jones on assembly."

"Who's going to do the welding?"

"Your apprentice."

"But we are piled up with work and he is not fast at it."

"Never mind, his welding is good."

"What is the matter with my welding?"

"Your last few jobs did not pass the inspector."

"Oh H——, that inspector is cock-eyed; he don't know nothing, etc., etc."

"I saw your welding and it was not as good as usual. Besides, I told you previously to be more careful about turning out better work. We cannot afford to let you waste any more work. Go out and work with Jones."

That man quit the next day. He was a good worker with an inflated estimate of his true worth. He was over-confident and arrogant. I might have been more tactful and told him to rest up his eyes a bit on some other job and he might have stayed.

—R. SENAY.

AL'S idea is very good and gives good results in most cases. But you must *know your man.* Putting Bill Jones to filing for a day will do him more good than talking since he will do a lot of thinking and looking ahead. It will also let him know that the foreman is really interested in his helper and is willing to teach him how to weld.

Bill Jones will be able to see that he can be replaced

if he quits or gets too independent on the job. The next day that Bill goes back to welding there will be a lot of difference in his work. Above all he will try to get ahead in it instead of holding back. At any rate, it never pays any foreman to have a man of that type around if he finds out that he cannot break him.

—J. W. CONRAD, *Master Mechanic.*

THERE are some men who cannot stand good treatment continuously without getting "cocky" like welder Bill Jones. Al possesses executive originality besides the faculty of treating his men as individuals and not in mass formation. Some men might have been beyond medicine and a surgical operation is then necessary to separate their company ties. There are other men who prefer to operate on themselves.

The only thing to worry about is that Al might have ruined the mental poise of Bill Jones' smart helper by giving him the job and the responsibilities of his boss for a day or so. Would it not be a pity to have saved one man's soul at the cost of another's? The possibility is there and it depends entirely on the stuff of which Bill's helper is made.

Bill Jones seems to be worth while and was big enough to see that the joke was on him. Some men with less spunk might have left in a huff to their own and the company's detriment. There is hardly a worse misstatement of facts than to say that all men are alike.

—A. D. SABORSKY, *Chief Engineer.*

Shop Visiting for the Foreman

THE man that is always trying to do his work a better and cheaper way should be given the privilege of visiting other plants in order to compare methods. The man who cannot leave his job or intrust it to a subordinate is too self-centered to gain by comparison because he wants to criticize and does not observe anything to be gained. William's theory would work out to make a better man of Al, and make Ed such a pest that he would make way for a progressive man in his department. —CHRIS. TERMEER, *Foreman.*

IF THE management would see the amount of good that might accrue to its own shop through sending foremen and engineers to other shops for visits, it might become more of a practice. If a man is good material for a foreman, he should be of a receptive mind, and if he is, a few days' visit to other shops should open his eyes to conditions in his own shop. It is as visitors that we can see conditions best in the other shop, and then comes the possibility of a comparison that should prove of benefit to us and our shop.

—C. G. WILLIAMS.

IT IS money profitably spent for a company to arrange a week every year for each foreman to visit in another plant, especially on work in conjunction with the line they are overseeing. This arrangement is so that not more than one foreman is absent from each department at any period.

I have been foreman and general foreman for the past sixteen years, and have had the privilege of making such trips to several large plants in the United States and Canada, and failed to return once without receiving as well as giving ideas which improved the processes. A report on each day of the week's survey, and an outline of improvements that have been initiated after the return to the shop, will satisfy the executive that it is money well spent.

—H. A. GILLILAND, *General Foreman, Canada.*

Should Foremen Accept Presents from Their Men?

PRESENTS should not be accepted from the men for the reasons Al gives, also because accepting these offerings puts the men under compulsion to subscribe or jeopardize their jobs, while the foreman in accepting cannot retain his full freedom of action.

There are, of course, times when a foreman can safely accept presents for services rendered, as for example from the welfare side of his firm or some social organization outside of the actual working of his department and yet partly connected with his men; but careful consideration of these is necessary.

—F. E. TERRY, *Ireland.*

THE giving of presents to any higher authority is to be deprecated because all subscriptions are not spontaneous. Some are given with a view to buying the recipient's goodwill. Those who would refrain from giving feel that they may thereby be inviting trouble and reluctantly fall into line.

Again, the promoters of such subscriptions are generally the greatest toadies in the shop. By acquainting their foreman with the news that they were the sponsors of the movement, they hope for special favor.

JAMES C. GILSTON, *Scotland.*

Taking Care of the Old Men

CONSIDERATION of long service men should have attention in all works. Williams' idea of getting these men out of the production gangs is all right to a certain extent, but personally I do not approve of placing them all together and forming an old men's brigade.

A man reaching this period in life wants personal consideration based upon his previous as well as his present abilities. To place a skilled mechanic on sweeping the floor is a poor class of consideration, for although his rate of production has lowered slightly, it will often be found that the accuracy is still maintained. Light maintenance work, production of spares, or repair work, are the kinds of work which might be given to these men without impressing on their minds the fact that they are not the men they used to be.

—H. HAYGARTH, *England.*

Which Kind of Man Is More Valuable?

PERSONALLY, after 20 years of control, I do not entertain a man for long who follows dog-like, or wants carrying about. Some foremen come down on their men and insist on being consulted on every trifling matter. But the docile man with no initiative whatever is a back number and the only hope for him is to invest on his behalf in a few shares in the firm. The small shareholder does avoid waste, even if he does consider himself one of the fixtures.

—J. H. COOPER, *England.*

Ideas from Practical Men

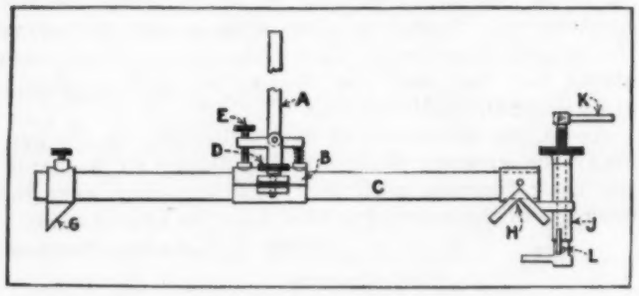
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Dial Indicator Stand for the Lathe

BY EDWIN KILBURN

In certain classes of lathe work it is difficult to use a dial indicator, because it is not always possible to get the carriage in a position that will allow the indicator to be used, when held in the toolpost in the usual manner.

The sketch shows a stand for use in connection with a dial indicator under such conditions. The indicator is mounted on the upright bar *A* which is pivoted to the sliding block *B*. Rough adjustment of the indicator may be made by sliding the block *B* along the steel tube *C* upon which it is mounted. It can be clamped in any position by the knurled head screw *D*. Fine adjustment is provided for by the screw *E*, in the same manner as the adjustment is made in any surface gage.



Lathe stand for dial indicator

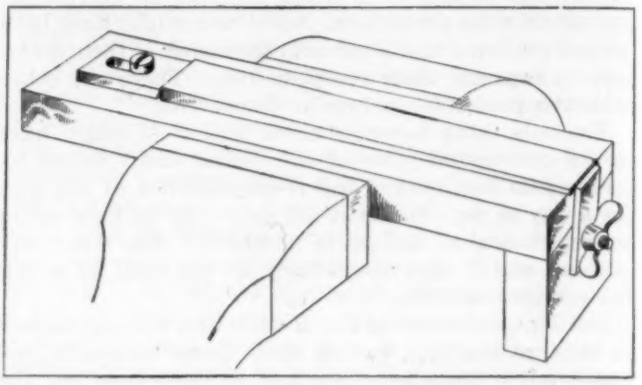
At each end of the tube *C* are angular pieces *G* and *H*, which rest upon the Vs of the lathe, one of them being adjustable so that the stand can be applied to different lathes. At one end of the tube is the clamp *J* by which the stand can be clamped to the lathe bed. The lower member of the clamp can be turned to engage or disengage it with or from the underside of the lathe ways by the handle *K*, its clamping position being determined when the stop pin *L* strikes against the lug shown.

A Fixture to Hold Tapered Gibs While Fitting

BY H. L. WHEELER

Long, tapered gibs are rather awkward pieces to hold while filing and fitting them, for the reason that they have no parallel surfaces. The illustration herewith shows a fixture by which they may be held conveniently.

The fixture is intended to be used in a vise, and holds the work by endwise pressure. It may be made from cold-rolled steel about 1x1½ in. in section, its length being made in accordance with that of the work it is to hold.



Fixture to hold tapered gibs

The stop at one end is adjustable in order to accommodate minor variations in the lengths of the gibs. An elongated slot made in the stop at that end provides this adjustment. The small movable clamp at the other end is tightened upon the work by a convenient thumbscrew.

Tapping Attachment Eliminates Hand Feed

BY T. N. LOFGREN

Having a large quantity of nuts to tap, and realizing the tedious task required in feeding the tap by hand, led me to construct the automatic tapping attachment shown in Fig. 1. The device consists of a ⅛-hp. motor and a bench-type hand-grinding unit. In Fig. 2 is shown a close-up view of the device. In place of an abrasive wheel, a pulley is attached to the grinder as shown. On the outer end of the drill press lever is attached a bar that in turn is connected to a crankpin on the pulley. In operation, the rotary motion of the grinder causes the spindle of the drill press to move up and down. By adjusting the connection to the drill-press lever, it is possible to obtain strokes of various lengths. To offset the irregularity of the crank motion and to allow the tap to feed into the work by its own lead, the drill-press lever is attached to the machine with sufficient play, or lost motion, so that the thread will not be stripped. There is also a certain amount of play in the driving unit, which assists in performing the same function.

On the table of the drill press is mounted a fixture having a slot in it into which the nuts are placed. The slot prevents the nuts from turning as they are being tapped. At first, an automatic-feeding attachment was

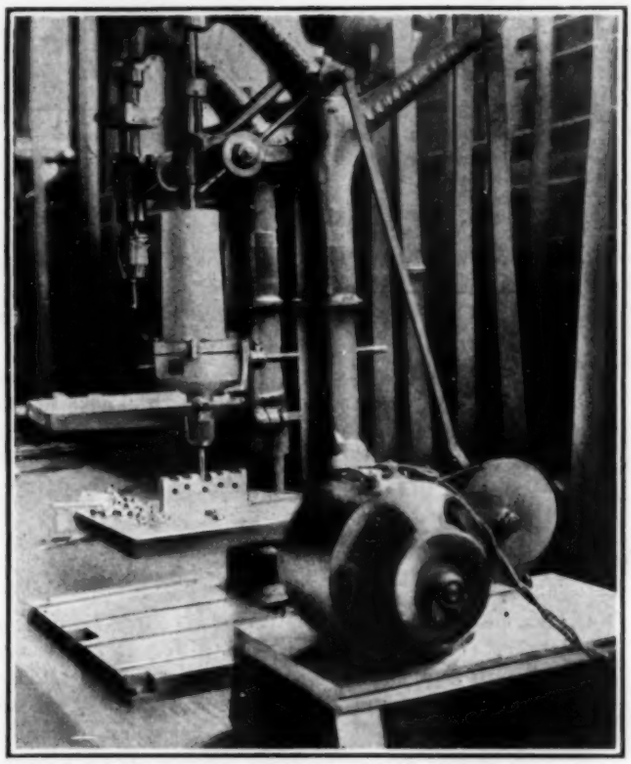


Fig. 1—Automatic attachment for tapping nuts

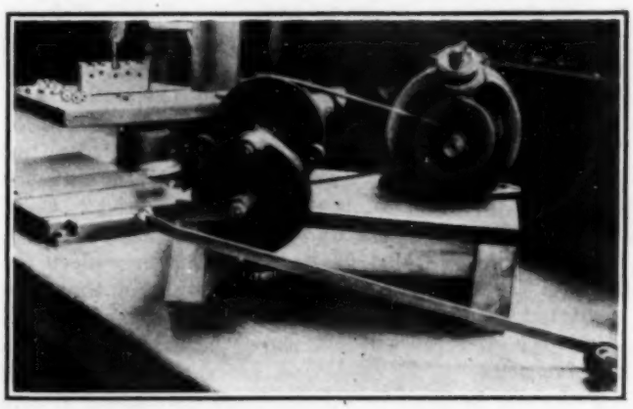


Fig. 2—Close-up view of the driving unit

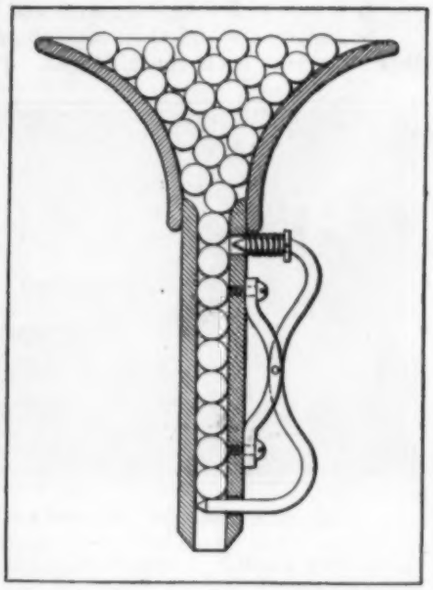
to be made, but inasmuch as the operator has sufficient time to load the fixture and tap a nut at each stroke of the press, it was decided to eliminate this feature. An Ettco tapping head is used in connection with the machine. By using various spindle speeds it is possible to tap different sized nuts without distortion.

Counting and Filling Device for Ball Bearings

By Joseph E. Abbazia

The device shown in the illustration is for the purpose of counting a given number of balls to fill a bearing and inserting them between the races. It can be made to handle any one size of balls and to count a given number of balls, but is not susceptible to alteration or adjustment in either respect. Its use by an assembler enables him to deposit the correct number of balls with certainty and with little chance of dropping any of them in the act of filling the bearing.

The device is made of brass tubing having an internal diameter that will just allow the balls of the size to pass freely. A funnel-shaped receptacle is soldered or otherwise secured to one end of the tube to act as a reservoir. Two small holes are cut in the wall of the tube to allow the pointed end of the tilting spacing-bar to enter freely. The distance between centers of these holes determines the number of balls that the device will count. The spacing bar is made of drill rod of any convenient diameter—in this case ¼ in.—bent so that both ends are at right angles to the tube when in position. It is pivoted at the center in such manner that one of the pointed ends can enter the tube through the hole in the wall only by withdrawing the other end. A coil spring encircling the upper bent end bears against the tube and holds the spacing bar always in the position shown.



Counting filter for ball bearings

To fill a bearing, the lower end of the tube is brought into position over the opening between the races, and pressure is applied by the operator's thumb to the tilting spacer to compress the spring, thus causing the upper bent-end of the spacer to enter the tube and to prevent the balls above it from falling lower. At the same time the lower bent-end is withdrawn, allowing eight balls immediately above it to pass out of the tube. Upon releasing the thumb pressure the tilting spacer returns to its first position, allowing the balls hitherto supported by the upper bent-end to fall until arrested by the lower one, when there will again be eight balls in position to be delivered.

Finding the Area of an Irregularly-Shaped Punching

By Charles Kugler

In the writer's experience in punch and die making, it has often been found necessary to find the area of irregularly-shaped metal stampings. This information is sometimes wanted by the cost department. Recently I saw a diemaker find the area of a die stamping ¼ in. thick and of an odd shape by a method that was very simple and quick.

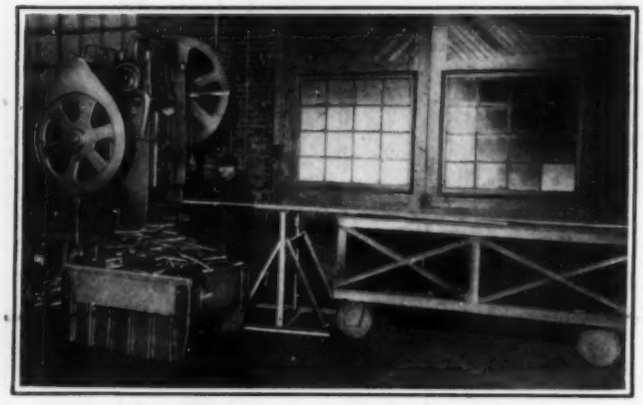
He carefully weighed the blank on a druggists scale and converted the result, which happened to be in troy weight, into pounds. By dividing the weight by 0.2834, the weight of a cubic inch of steel, he obtained the cubic inches in the blank. The area of the blank in square inches is found by dividing this cubical content by the thickness, in this case ¼ inch.

Bar Supports for a Press

By J. O. Wood

In performing press operations on bars, it is very convenient to have the work supported at the same height as the press tools, and to have some method by which it can be fed as the pieces are blanked or cut off.

The roller rest and the truck shown in this illustration represent such conveniences. They can be fabri-



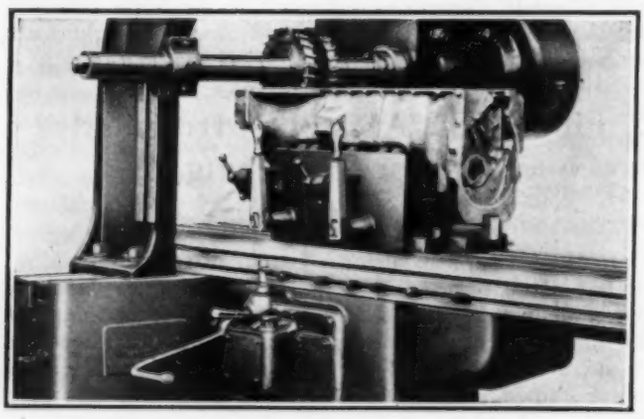
Arc-welded roller rest and truck

cated very cheaply from standard bars and shapes by the arc-welding process and can be made of any required height, width, or length by varying the length of the bars and shapes.

Milling Cap Seats in Aluminum Crankcase

By J. F. Watson

In finish milling the cap seats in the crankcase of the Cadillac motor, the work is done on a Cincinnati 48-in. plain automatic machine, in which the head and footstocks are supported at a point considerably higher than is usual. In addition, a table of extra length is required, so that the work can be loaded and unloaded from opposite sides of the machine without interfering



Milling bearing seats

with either the stationary parts of the machine or the cutters.

The work is located in the fixture shown in the illustration, in hardened strips upon which the pads for the cylinders bear. Two 14-in. inserted-blade, half-side mills are used, being carried on a 2-in. arbor.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Blanking Clean Fiber Washers

Q. We are having difficulty in blanking fiber washers without a sharp burr. The material is about ⅛ in. in thickness. What is the proper clearance for the die in order to leave a clean edge on the washer?

A. A proper procedure is to leave no clearance on the die for a distance greater than the thickness of the fiber, and then back it off sharply. The punch should be a very tight fit. It is important to have the fiber sheet absolutely dry. If the material is slightly damp a burr will be raised.

Colors in Heating Steel

Q. We have been quenching nickel steel for hardening at a cherry red heat, but find that different handbooks give different temperature values for cherry red. Please tell us the exact value of this color. We want to quench from 1,350 deg. F. What is the proper color to use?

A. You cannot expect uniform hardening by quenching from colors seen by the eye. In the first place no two workmen are likely to agree on what is "cherry red." Then again, the eyes of different workmen vary, and furthermore the metal itself gives off a different color under varying conditions.

We note that one handbook gives the temperature for "cherry red" as 1,375 deg. F., while another places it at 1,652 deg. F. There is likewise a variation of as much as 290 deg. in what different tables list as "red." Color is the resultant effect of light waves on the normal eye. Different compositions of metal absorb or reflect the light in varying degrees, and if the light of the room is altered the color perceived will also be changed. A thin piece of steel will not show the same color as a massive piece.

One color book gives 1,115 named colors, but it is a recognized fact that many thousands more color shades can be distinguished by the normal eye. It is therefore easy to see how a workman can vary temperatures several hundred degrees due to differences of opinion as to the proper color. A variation of a hundred degrees in the hardening temperature of important pieces of work made of special steels is sometimes of vital importance, and no shop having such work should rely on the color method of determining the temperature.

Lubricant for Heavy-Duty Bearings —Discussion

By Eric Hawthorn Thwaite

On page 222, Vol. 66, of the *American Machinist*, a correspondent reports the heating of bearings under heavy pressure, and requests information about graphite as a lubricant. Where bearings are subject to heavy pressures and journals do not travel at a very high speed, castor oil makes an excellent lubricant. This oil may be applied in the usual way without fear of clogging or gumming up.

Characteristics of Enduro Stainless Iron

Enduro stainless iron is a special rustless iron-chromium alloy. It has properties that enable it to resist atmospheric moisture and sea air indefinitely. Many chemicals which attack iron and steel do not have any apparent effect on it, particularly superheated steam, sulphur fumes, nitric acid, and oxidizing agents. This property, which is characteristic of the high-chromium alloys, also enables it to resist scaling and oxidation at high temperatures.

Enduro stainless iron is an electric furnace product, with the following typical chemical composition:

Carbon—under 0.10 per cent
Manganese—under 0.50 per cent
Silicon—0.60-1.10, depending upon the usage
Chromium—16.5-18.5 per cent
Nickel—under 0.25 per cent

The melting point of the metal is 2,750 deg. F., and the specific gravity is 7.67, or about 98 per cent of that of steel.

Enduro can be handled in various fabrication processes in a similar manner to ordinary steel. It is available in plates and sheets of commercial sizes, both pickled and with polished ground surfaces. Billets and slabs are also on the market, as well as bar stock, both hot rolled and cold drawn, in rounds, hexagons, squares or flats. Seamless drawn and welded tubing is produced in a large range of sizes, and the metal is also made into rivets, bolts, screws, wire, and hot and cold rolled strip.

Enduro may be forged in a similar manner to 0.40 carbon steel, it can be riveted, deep drawn, spun, and formed in much the same manner as ordinary steel. Machining presents no special difficulties.

Welding may be done by the oxy-acetylene process or by the electric arc. In gas welding, a slight excess of acetylene is advisable. The weld should not be puddled nor the rod removed during the operation. A bare Enduro rod should be used. For arc welding a specially coated Enduro rod is claimed to give satisfactory results with a current of about 40 volts and from 80 to 100 amperes. As with all high-chromium alloys the weld is coarsely crystalline and lacking in ductility. As the carbon content of Enduro is very low there is little tendency to air hardening, but it is advisable to anneal after welding by heating to 1,400 deg. F., and cooling in the air. Enduro may be spot welded satisfactorily on any of the usual types of spot welders. Enduro, however, cannot be hammer or forge welded. Soldering and brazing of Enduro are done by first cleaning the surface with hydrochloric acid and then tinning.

The physical properties of Enduro are comparable to a medium carbon steel. The results of the physical test of a ¾-in. round bar cold drawn to ⅝ in., are shown in the accompanying table. Hot rolled 14-gage sheets gave an ultimate strength of 85–95,000 lb. per sq.in., and when box annealed at 1,550 deg. F. for 8 hours gave 70- 75,000 lb. per sq.in. ultimate strength, and up to 22 per cent elongation in 8 inches.

Physical Properties of Enduro Bars

	Hot Rolled	Annealed at 1,450 deg. F.	Cold Drawn	Cold Drawn and Annealed
Ultimate strength lb. per sq. in...	90–100,000	75–80,000	90–95,000	70–75,000
Yield point lb. per sq. in...	65– 75,000	55–60,000	85–90,000	45–55,000
Elongation in 2 in. per cent.....	30–35	25–30	12–15	30–35
Reduction of area per cent.....	55–65	65–75	60–65	70–75
Brinell, per cent.	155–165	145–155	195–200	135–145
Rockwell "B"...	90–94	86–90	96–100	82–86

On account of the high chromium content, Enduro resists oxidation and scaling under continuous service up to about 1,650 deg. F., and for the same reason the physical properties are claimed to be well retained at high temperatures. Enduro at a temperature of 900 deg. F. can be expected to maintain a static stress of 35,000 lb. per sq.in. for a long period without deformation, and at 1,300 deg. F. will withstand a stress of 3,500 lb. per sq.in. without deformation.

Because of the ratio of chromium to carbon content, which is higher than the average "stainless iron," Enduro is claimed to possess superior corrosion resisting qualities. When ground and polished, it takes a beautiful silvery white lustre, which is permanent and untarnishable under ordinary atmospheric conditions. It is used to replace metals that require nickel plating, or as a substitute for many more costly white alloys.

In addition to nitric acid in all concentrations Enduro resists cold acetic acid and solutions of caustic alkalies, or alkali carbonates. Ammonia has no effect in any strength of solution, and wet or dry gas does not attack the metal. Salt brine has no action when the articles are completely submerged or are alternately wet or dry. When partially submerged there will be pitting along the water line with some concentration. Vegetable and fruit juices do not attack Enduro. Other chemicals which in general do not attack it are hydrogen sulphate, sulphur dioxide, and ammonium chloride.

Enduro is attacked by certain chemicals such as hydrochloric and sulphuric acids, formic acid, oxalic acid and the bromine and iodine compounds, or chlorine gas. It is also subject to attack by molten zinc.

Enduro finds its greatest use as a "stainless iron" because of its exceptional resistance to atmospheric attack and to the action of ordinary chemicals. It is used for the manufacture of automobile parts, chemical plant apparatus, enameling racks, furnace parts, laundry machinery, marine supplies, mining machinery, oil refining equipment, and valves.

For the information given we are indebted to the Central Alloy Steel Corporation

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Technical Abstracts

Investigation of Bolt Steels

The advent of higher temperatures and pressures in the oil refineries and power plants has created a demand for materials of greater strength and rigidity. Exhaustive tests of bolt steels, covering a period of years, have been made. The investigations cover failures under actual working conditions, remedies and recommendations based on results. Engineers are making careful examinations of the character of bolt materials for certain uses as bolts are important links in their work.

Not only are heat-treatment, physical tests, and chemical analysis of raw material important, but particular methods of manufacture and rigid inspection are necessary for heavily stressed parts. To meet these demands, a heat-treated alloy steel bolt has been recommended to supplement the carbon steel bolt. Modern methods of testing are advocated, especially high temperature short and long time testing.

Opinion is expressed that all of the advantages claimed for casehardened nuts may be had without the bad effects by the use of a medium carbon heat-treated steel nut.—V. T. Malcom and J. Juppenlatz, *Transactions of American Society for Steel Treating*, February, 1927.

Ventilation of the Industrial Plant

The new conception of air hygiene is that the effect of air is upon the skin and upon those organs which receive the stimulation through the skin. It is this view of the effects of air upon the body that necessitates a complete revision of ventilation equipment.

Air to be refreshing to the skin and stimulating to the body must be moderately cool, in gentle motion, moderately moist, and slightly variable in temperature. Mechanical ventilation largely ignores these requirements, and aims to deal with the impurities in the air by providing a certain number of air changes per hour. In order to deliver air at a velocity believed to be desirable, and to avoid drafts, it is necessary to heat it to a temperature too high for health and comfort.

Experiments show that in cool, moving air the health of workers is improved. They are less susceptible to colds, and there are fewer absences due to sickness. Both mental and physical efficiency are increased by good ventilation.

The thermometer is an essential equipment in ventilation, and the air of the room is varied between 66 and 68 deg. F. Heat must be kept well controlled by the careful attention of the engineer, or with the aid of a reliable heat regulator. It is evident that the new ventilation cannot be automatic. In factories an employee from each department should be delegated to serve as the ventilation chief.

It may be objected that constant supervision is costly. The saving in the cost of ventilation equipment should be considered, together with the cost of operating such devices and the cost of fuel. But the greatest saving is in the reduction of sickness. At the Hawk-Eye plant of the Eastman Kodak Co., in Rochester, employing about 600 workmen, the system of mechanical ventilation was scrapped, and a system of window-gravity ventilation installed. A temperature chief was appointed in each department. In the first year the absence from illness was reduced one third, and hours lost and sick benefits paid were cut in half. There was also a saving of 10 per cent in fuel used.—T. D. Wood and E. M. Hendriksen, in *Industrial Management*, January, 1927.

Causes of Unsatisfactory Finish in Grinding

In precision cylindrical grinding trouble is experienced at times in obtaining the quality of finish or degree of accuracy desired. These difficulties are usually of the nature classed as "chatters," "spirals," or "out-of-round."

Chatters may come from several causes, but are mostly due to out-of-balance grinding wheels. It is not possible for makers to produce grinding wheels which are all of uniform density throughout. This condition is corrected by counterbalancing, but if the heavy spot is located near the periphery the wheel will be out of balance when it is worn. Wheels used for cylindrical grinding should be balanced after the diameter has been reduced 2 in., and every 2 in. thereafter.

A poor machine foundation, or vibrations of the floor, may also cause trouble in finishing to a fine surface. Belt lacings or poorly lapped joints may set up a pounding action which will be reflected on the surface ground. Slipping belts will produce finish blemishes. Improper surface speed of the work, or a wheel of the wrong grade, may also be responsible for chatters.

Spirals, or feed lines, are almost certain to be produced on heavy cutting where the grinding wheel is too hard or glazed. The manner of feeding the wheel into the work, and the table traverse speed used, are also factors worth considering when trying to eliminate spirals. Spirals may also be produced when the spindle is not parallel with the direction of traverse of the work in all planes. To overcome this condition it is necessary to scrape the bearings of the wheel slide or the table ways to correct the alignment of the machine.

Work out-of-round is usually caused by one of four factors: Centers or center holes not perfectly round, too scant a flow of cutting lubricant on the work to keep it at a uniform temperature, the use of improper steadyrests, or a wheel too hard in cutting action.

Chatters and spirals that are discernible to the eye may be so slight that sensitive measuring instruments fail to show the variation and the out-of-roundness may show only a small fraction of a thousandth of an inch. However, grinding machines are being made capable of producing the most exacting requirements, and the continuance of this ability rests only in the proper maintenance of the machine.—C. H. Hill, in *Grits and Grinds*, January, 1927.

Testing Flow in Metals at Various Temperatures

In modern electric power plants, temperatures up to 750 deg. F. with pressures of 600 lb., and in one or two cases 1,200 lb. per sq.in., are in use commercially. Such service naturally urges as close duplication of operating conditions in a test of materials as it is possible to obtain. For testing materials subjected to these conditions at the Crane laboratories, it has been necessary to design special machines, inasmuch as the regular laboratory physical testing machines could not be spared for such long periods of time, as would be necessary and, furthermore, such machines are not as adaptable or as accurate for "long time" testing as are the simple lever dead-weight machines.

Test specimens are turned either to the standard 0.505-in. diameter or to ¼-in. diameter, the former being used for tests at high temperatures where the lowered strength, due to temperature, will not be subjected to as great an inaccuracy as would be the case if specimens of smaller cross section were used. Temperature control is maintained by two thermocouples in drilled holes in the top and the bottom of the specimen. These thermocouples connect with a Leeds & Northrup controller-recorder that cuts off the current from the heating coil when the temperature gets 5 to 10 deg. F. above that desired, and cuts it in again when the temperature of the specimen sags 5 to 10 deg. F. below. This regulation results in the well-known wavy line drawn by the pen on the recorder sheet. The sensitivity of the machine is such that these waves on the recording temperature chart are repeated in much smaller waves on a Bristol motion-time chart drawn by the motion of the beam. These two sets of waves synchronize, showing that the expansion and cooling over a range of 10 to 20 deg. F., holds the lever freely upon the knife-edges.

When the break occurs, a cutoff switch, placed beneath the lower holder, is operated by the dropping of the holder and the bottom half of the test specimen. Inasmuch as the motion time recorder gives only a rough measure

of the stretching of the test specimen, a specially built two-telescope extensometer is used. With this instrument, movements over a gage length of the test specimen can be read within 0.0005 inch.

The machines are designed for the testing of materials as high as 250,000 lb. per sq.in. tensile strength. This capacity is desirable because materials of much higher strength probably will have to be considered before long in the field of high temperature engineering.—By L. W. Spring, H. W. Maack and J. Kanter, *Power*, Feb. 8, 1927.

Industrial Electric Heating

S. E. Monkhouse of the Newcastle-Upon-Tyne Electric Supply Co., Ltd., read a paper at a conference of the Electrical Development Association in which he disagreed with the view that industrial heating business would be developed only if electricity were sold at a price which was competitive on a heat basis with that for other classes of fuel. There are, he claims, many cases where processes could be completed more economically by employing electricity than by employing other media. One important feature of an electric furnace is its high efficiency at high temperatures. At temperatures round about 2,400 deg. F., gas, coal and oil had efficiencies of from 10 to 20 per cent; in the case of electricity it was 75 per cent. Other advantages were close temperature control, ability to apply heat where wanted, avoidance of cold spots, control of rate of heating, absence of fumes and soot, automatic stopping and starting and reduced maintenance costs.

The author mentioned steel annealing, paint drying, vacuum drying and other processes as typical installations in operation, giving a comparison of the cost when using electricity as compared with the fuel used previously as well as the reasons why electricity was adopted. This produced many points in favor of electricity. The application of electricity for the heat-treatment of colliery drills and coal cutting picks used in mechanical coal cutters was also advocated.

A recent important development was an apparatus which made use of high frequency currents for the production of intense local heat.—The *Electrical Review* (England), Feb. 4, 1927.

Furnace Atmosphere Is Regulated Automatically by Meters

Generally, the heating or annealing of steel sheets, bars, billets or forgings, requires that the stock be heated to a certain uniform temperature in a non-oxidizing furnace atmosphere. Free oxygen in the products of combustion will scale the steel excessively, resulting in loss of metal. However, in the case of sheets, a thin uniform scale is necessary to prevent them from sticking together when being rolled in packs.

Operation of the furnace so that the atmosphere will be just sufficiently reducing, with a safe margin to obviate danger of excessive scaling, can be accomplished by the use of suitable equipment for analyzing the flue gases, which will measure continuously the reducing or oxidizing conditions in the furnace in per cent. Such equipment often consists of an electric carbon-monoxide meter that measures the per cent of carbon monoxide and hydrogen in the gases of combustion in the furnace.

A continuous gas sample of about 0.7 cu.ft. per hr. is drawn from the furnace through a sampling tube of water-cooled construction, or of heat-resisting material. The gas sample is cooled to remove moisture, filtered and then passed through instruments that give the analysis on large dial indicators, or on a continuous chart, about two minutes after the sample leaves the furnace. This record is taken 24 hr. a day. If the analysis shows that the furnace atmosphere is too sharply reducing, or that the gases are becoming oxidizing in character, quick changes in the fuel-air mixture can be made.—Richard Rimbach and J. A. Stein, *Iron Trade Review*, Feb. 17, 1927.

The Heat Treatment of Duralumin

When certain light aluminum alloys are heat-treated, quenched and aged there is considerable improvement in their tensile properties. When heated to a temperature of about 500 deg. C and quenched in water there is a period immediately after the quenching when the material increases in hardness and tensile strength with time. After several days aging the duralumin attains constant hardness and tensile properties. Cast duralumin responds somewhat to heat-treatment, but the form in which this alloy is used is as a wrought product so our discussion will be confined to the latter. To keep duralumin soft and workable over a period of time it can be annealed by heating to about 350 deg. C. and allowing it to cool in air.

It is interesting to note the low values obtained by heating to about 320 deg. C. and quenching and the high values obtained by heating to about 500 deg. C. and quenching.

The ordinary quenching mediums are air blast, water and oil. The physical properties resulting from an air blast quench are less than those resulting from a liquid quench. Quenching at 100 deg. C. and aging at room temperature seems to accelerate the aging process. Aging is practically complete after about four days.

Heating of duralumin for heat-treatment may be done in a furance or in a salt bath. The use of an open flame is not satisfactory on account of non-uniformity of such means. The furnace can be heated by electricity, oil, or gas. Coke, coal or charcoal are not used owing to the formation of explosive mixtures when carbonaceous fuel gases come into contact with nitrates. The best practice is to use sodium nitrate and potassium nitrate for the salt bath. When in the annealed state duralumin can be drawn, stamped, formed and otherwise worked until the metal becomes hard through mechanical working.

Very little of a novel nature has come out on heat-treating duralumin in recent years and there is reason to believe that the practices are very nearly standardized. There is a leaning towards the electric furnace to reduce corrosion from the nitrate salts, but uniformity of heating and accurate control of temperature are both obtainable with salt baths.—*Aviation*, Feb. 21, 1927.

Stress Distribution Indicated by Special Etching

After much research a process has been developed to produce strain-etch figures in a steel specimen. The piece is first given a short low-temperature anneal, after which it is machined or sectioned to present a smooth surface. It is then immersed in an acid solution of copper chloride for a varying, but often prolonged period. Strain-etch figures are produced as a result of a marked preferential attack of the solution on that part of the steel that has locally been permanently deformed. This etching occurs on some steels but on others of practically identical chemical composition and microstructure, it does not—why is not known.

The figures produced are so uniform in general character and so obviously related to theoretical stress distributions calculated mathematically that their true significance cannot be questioned. They also check the "Lüders Lines" phenomena in that they show that the oriented bands on the surface are manifestations of solid blocks of permanently deformed metal in the mass of the specimen. In their initial stages these blocks are wedge shaped and are considerably harder than the surrounding metal.—J. D. Jevans, in *Engineering*, Feb. 11, 1927.

Pack Hardening of Various Steels

While the automobile manufacturers have their own standard steels and practices plants devoted to the building of dies for sheet metal stamping do not employ S. A. E. standards. Consequently, owing to the fact that the building of dies cannot be carried out on a production basis and the sale is subjected to keen competition, it is necessary to use the cheapest steels which will stand the strains. The expense of high grade steels can be considerably reduced by the use of steels that can be pack hardened.

In selecting the grades of steel to be used, the type of die to be built must be taken into consideration as well as the gage stock that is to be run through the dies.

For certain parts of dies high grade tool steel must be used. The best grade of machine steel cannot be heat-treated so that a shock or compression resisting core can be obtained. In forming dies, where the stock to be formed is subject only to a metal to metal contact, machine steel, pack hardened, is very satisfactory.

Pack hardening also eliminates soft spots in tool steel. The carbon content of a piece of water hardening tool steel, having a carbon content of 1.10, was packed in pearlite at a temperature of 1,750 deg. for three hours and the carbon content was increased to 1.23 by actual analysis.—*Forging - Stamping - Heat Treating*, February, 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

The Farmer as Engineer

THE introduction of practical engineering research into the work of the farm is advocated by the United States Department of Agriculture in a recent report, and to back up its plea it has brought out more than 400 specific suggestions for experimental research relating to mechanical farm equipment.

Anyone who has visited a modern farm knows that the terrible drudgery of the farm hands of 30 years ago is at an end. The gasoline engine, the tractor, the reaper, and a hundred other mechanical appliances have lightened the burden of the farmer. But the Department of Agriculture apparently does not intend that the farm shall lag behind other industry. There is no halt to the introduction of labor saving machinery in industrial plants, and the farm need not be an exception to the rule.

More and more the agriculturist should be able to turn to machinery to help solve his problems, and more and more should the mechanical engineer turn his attention to the improvement of farm machinery. In the industrial revolution which Mr. Hoover says is now in progress the manufacturer has solved complicated problems to the satisfaction of both labor and capital by the introduction of special machinery. If the Department of Agriculture and the mechanical engineer can show how the same thing can be done for the farmer there will be no need for him to put his attention on attempts to better his condition by laws that are unsound and uneconomical.

Over-generous Compensation

EVERY one who has ever served on a petit jury in an accident case knows how the average juror looks on compensation. The first thing he wants to know is how well off the defendant is, and the next whether he represents a corporation. If he is comfortably supplied with this world's goods the chances are that he will be made to pay whether the facts in the case show him to be culpable or not. If a corporation can be involved there is no doubt but that the plaintiff will get heavy damages.

Unfortunately, the same mental attitude seems to affect those connected with either the framing or the administration of workmen's compensation laws. There are many instances on record where the connection between the alleged accident and the incapacity of the worker was exceedingly remote but in which full compensation for disability was awarded.

The employer of today is generally human and anxious to relieve the suffering and perhaps privation of a worker injured in his plant by reason of some hazard of the industry. Employers, as a group, are much more enlightened than they were a generation ago. But they must keep an eye on the type of legislation that places on them an undue compensation burden, and particularly on administrative officials whose sympathies outweigh their sense of justice.

On German Patents

MANY American machinery manufacturers have suffered from foreign competition in the form of "Chinese" copies of their products. This form of competition has been particularly keen from German firms which have often been entirely within the German laws in so doing. Much of the annoyance under which the American manufacturers are fretting could have been avoided had they taken full advantage of the protection afforded by the patent laws of Germany. Some of them failed to do so through ignorance, others through negligence.

One of the important factors in the application of the German regulations is that of publication. As explained in detail in the leading article of this issue a published description of a device operates to prevent the issuance of a patent.

It is too late for many American firms to protect some of their products but they should not be caught again. The German courts will give them protection if they have a case.

The Sherman Anti-Trust Law Sharpens Its Teeth

WHAT can and cannot be done by trade associations becomes somewhat clearer as a result of the Supreme Court decision in the Trenton Potteries case. The principal point clarified by the decision is that the reasonableness of the prices established by a combination of individuals or companies has nothing whatever to do with the law. If there is restraint of trade or fixing of prices the law has been broken. The only recourse of those who do not believe that unrestrained competition is for the best interests of the community lies in amendment of the Sherman Law. The courts have decided what the law means and their duty ends there.

It is interesting that some of the incriminating evidence came from the correspondence files of the defendants.

Shop Equipment News

Harrington Multiple-Spindle Drilling Machines with Oilgear Feed

THE Harrington Co., 17th and Callowhill Sts., Philadelphia, Pa., has redesigned its vertical and horizontal multiple-spindle drills to include the Oilgear feed. In the incorporation of this device the rack and gear, common to drills of this class, have been eliminated, and the feed is applied through balanced pressure cylinders. The feed control of the vertical machine is obtained by means of either the foot pedal at the front of the machine or the hand lever on the side of the column. The control on the horizontal machine is through convenient foot levers at the front of the machine.

In the vertical type of machine the base, column, bracket, spindles, head, and gear chest are the same as for the previous standard No. 63-B machine. The vertical machine, shown in Fig. 1, was designed especially for the drilling of the web in heavy structural beam and column units, and the horizontal machine with two opposed heads, shown in Fig. 3, is intended for drilling both flanges of beams and columns up to 30 in. in depth.

The improved features of the machines are the Oilgear feed and the feed control arrangement. On the vertical machine the Oilgear QH pump and the driving motor are mounted at the rear of the machine. Two hydraulic cylinders are mounted on top of the machine directly in line with the guides in order to obviate any binding action of the head in the motion. In the piping from the pump numerous fittings have been avoided by the use of bent pipes with the object of increasing the efficiency of the hydraulic transmission. The automatic feed is controlled by a system of three bars, shown in Fig. 2, at the right-hand side of the machine and is capable of ready adjustment. Complete control is had throughout the entire travel of the spindle head. The latter is arranged for rapid approach, coarse feed and a fine feed for "breaking through," and rapid return traverse. These movements are controlled automatically by the setting of the bars, but at any point of the stroke the head can be thrown by hand into the rapid return traverse. The readings on the pressure gage are claimed to give an accurate indication of the proper feed pressure.

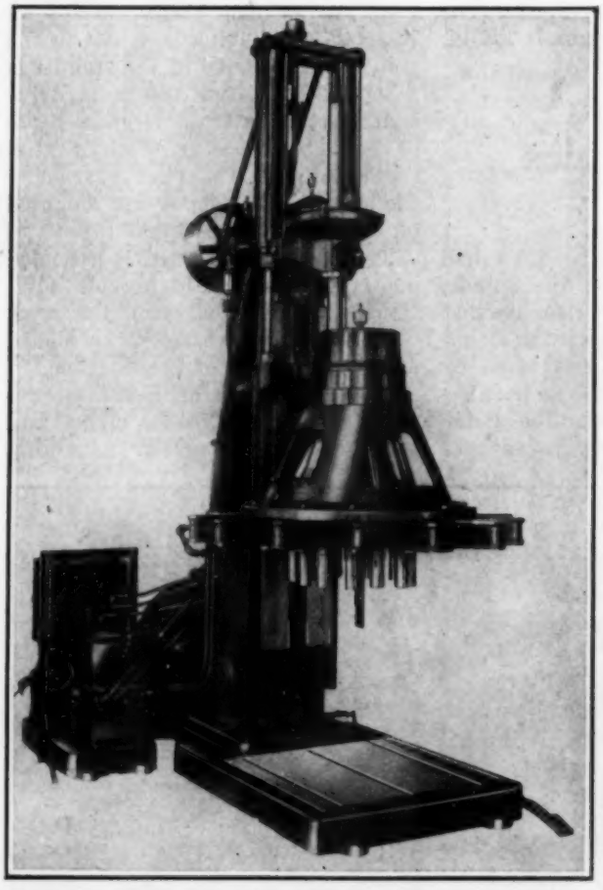


Fig. 1—Harrington Multiple-Spindle Drilling Machine with Oilgear Feed, Vertical Model

The machine shown in Fig. 1 has a maximum drill area of a circle 29⅜ in. in diameter, and a minimum center to center distance of spindles of 2¾ in. The spindle equipment consists of multiple spindles with 2½ in. diam. "oil-well" universal joints capable of driving 1⅞-in. drills in structural steel. A supplementary set of smaller spindles is also furnished with this machine. These spindles have a minimum center distance of 2¼ in., and are capable of driving drills up to 1⅛ in. The "oil-well" universal joints are especially designed to provide for thorough internal lubrication of the spindles. The joints will operate at a 30-deg. angle. The oil hole through the center delivers oil through two side outlets into a channel on the back of each trunnion, and the oil is thrown by centrifugal force into the trunnion bearings.

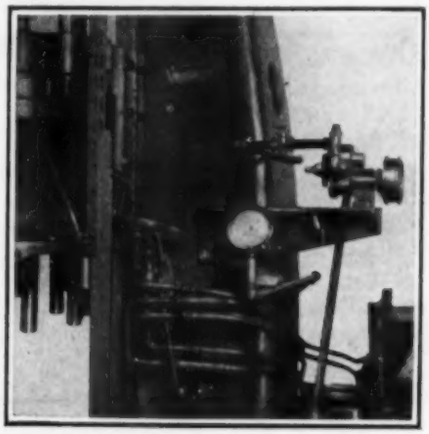


Fig. 2—Feed control mechanism

The machine is equipped with a 40-hp. motor with convenient push-button control and dynamic braking. A coolant pump is mounted on a bracket on the side of the machine, and is arranged to give a liberal supply of coolant to the drills.

The horizontal machine has two 40-hp. motors mounted in the rear, and an arrangement is provided by means of equalizing bars in the rear of the bed to obtain a uniform feed of both heads. Each motor drives through a silent chain to a set of spur gears connected to the head. An

Shop Equipment News

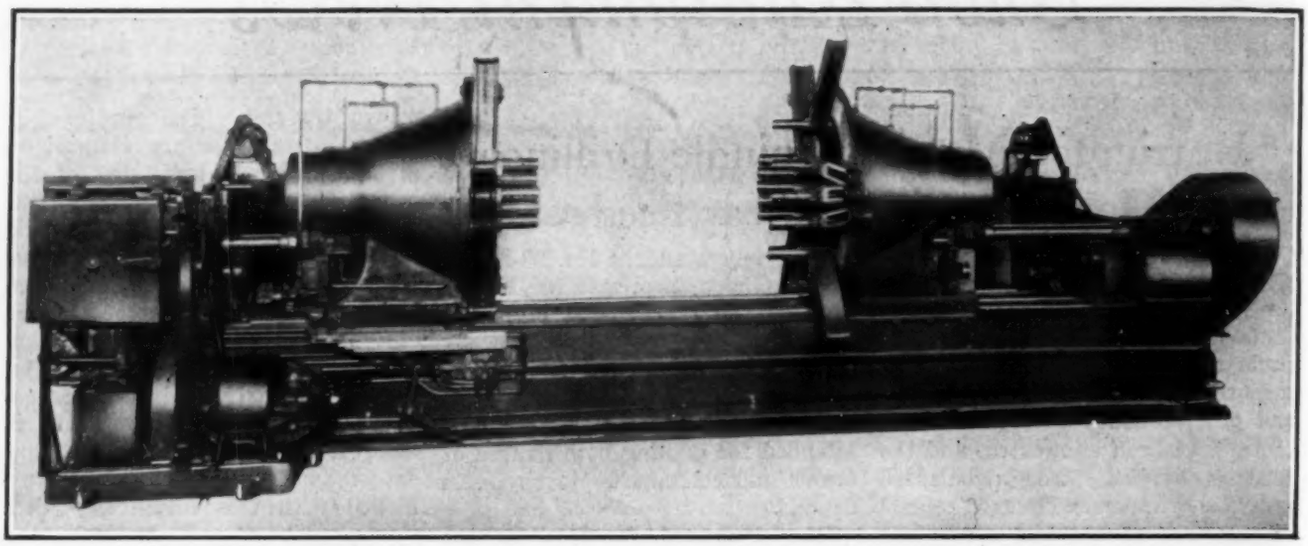


Fig. 3—Harrington Multiple-Spindle Drilling Machine with Oilgear Feed, Horizontal Model

oil pump is arranged to distribute oil to all spindles and bearings in the heads. The control of the driving motors is by means of push buttons at the front of the machine convenient to the operator. In the horizontal machine the Oilgear pump is located at the rear conveniently accessible, but out of the line of interference of the work or of the operator.

The Oilgear pump, as provided with these machines, consists of a constant-delivery, low-pressure pump for the rapid traverse, and a variable-delivery, high-pressure pump for the feeds. The rate of feed is easily adjusted by means of two set screws on the pump, and the feed may be varied from 0 to 20 in. per min. The feed for the rapid traverse is 120 in. per minute.

Barnes No. 410 Horizontal Duplex Drilling Machine

THE No. 410 horizontal drilling machine illustrated is being made by the W. F. and John Barnes Co., Rockford, Ill., for general horizontal drilling up to a capacity equivalent to a 1-in. drill in steel. In addition to simple drilling this machine may also be adapted to core drilling, boring, reaming, counterboring, chamfering, and facing. Special controls may also be incorporated to provide for tapping and threading.

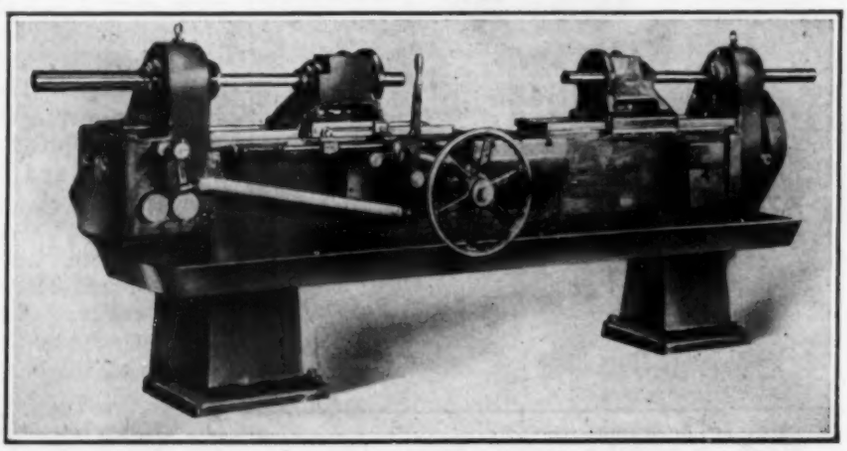
The bed is a heavy semi-steel casting provided with cross ribs to prevent deflection. The flat ways are of a hard, close grain and are accurately scraped to furnish bearing for the heads. While the bed is furnished in a standard length, extra bed lengths can be supplied to meet the purchaser's requirements.

The heads and saddles are cast integral and are gibbed to the ways. The spindle bearings are bronze and the drilling thrust is taken against the rear wall of the head on ball bearings. A collar on the spindle back of the head provides for the taking up of wear. Longitudinal adjustment of each head is made by loosening two clamp nuts so that the feed nut is permitted to turn in the carrier and in this way to advance the head along the stationary feed screw to the desired setting.

The spindles are made of alloy steel, 2 in. in diam., and are accurately ground. They are provided with a No. 3 Morse taper. The spindle drive is through a special gear-driven sleeve carried in the end gear boxes. The sleeve carries an inserted key driving in a slot in the spindle. The drive of the spindle is taken directly from the main drive shaft through a train of gears made of heat-treated alloy steel of stub tooth design. The idler gears and the spindle drive sleeve are mounted on Hyatt roller bearings.

The center of the bed is extended out on either side to provide additional width for carrying the work table which has two T-slots furnished as a regular part of the machine.

Power feed to the heads is provided through a heavy right- and left-hand feed screw extending



Barnes No. 410 Horizontal Duplex Drilling Machine

Shop Equipment News

throughout the length of the bed and placed directly under the center of the saddle. This feed screw engages bronze feed nuts clamped in the nut carriers as previously mentioned. A gear box at the left end of the machine contains the feed mechanism and provides for changes of feed by means of pick-off gears. Three combinations of feeds can be provided: Hand traverse by the pilot wheel, shown in the front of the machine, and slow power feed with automatic knockout; hand traverse by the pilot wheel, slow power feed with automatic knockout, and automatic quick return; and hand traverse by the pilot wheel, power feed with tap lead, and automatic reverse. Drive shafts in the feed box are carried in bronze bushings. The control of the feed mechanism is at the front by means of a lever shown above and to the left of the pilot wheel.

The machine is driven from one drive shaft along the back of the bed to which are attached tight and loose pulleys 14 in. in diam. with belt shifters, if belt drive is desired. If motor drive is specified, the motor is mounted on the rear of the right-hand leg and connected to the main drive shaft by a silent chain. Cast-iron guards completely inclose the chain and sprockets. If belt driven, the machine requires only one 4 in. belt, as spindles, feed and the coolant pump are all driven from the main drive shaft.

The coolant tank is cast into the left-hand leg. The pump is mounted on the rear of the bed and is gear driven from the main drive shaft. A chip pan carried under the full length of the bed collects both chips and coolant. It returns the latter to the coolant tank.

All gears both in the spindle drive boxes and in the feed boxes are splash lubricated.

SPECIFICATIONS

Height of spindle above ways, in.	5⅞
Height of spindle above table, in.	7½
Max. distance between spindles, in.	43
Min. distance between spindles, in.	9
Total travel of each head, in.	17
Spindle speed, r.p.m.	100 to 600
Feed per revolution (Standard), in.	0.005 to 0.020
Distance from floor to center of spindles, in.	38
Dimensions of table, in.	14½x17½
Floor space required, in.	120½x32½
Domestic shipping weight, lb.	2,900

Milburn 3-in-1 Paint Spray

The Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md., has developed a 3-in-1 spray gun which is adaptable to very fine work such as painting and lacquering automobiles, or for coarse operations such as painting machinery, freight cars, buildings and the like. It is a triple-purpose gun with siphon-feed, pressure-feed or gravity-feed spray. It can be instantly adapted for any of these methods of spraying.

The multiple-head adjustment permits either a flat, fan spray in either a horizontal or vertical position, or a round spray by a simple adjustment. It is claimed that the atomization is so fine and even that "orange-peel" effect is eliminated and sanding and rubbing is minimized. The spray can be so closely adjusted that it can be used for touching up, shading and high lighting. An air pocket formed by the fan-shaped nozzle completely surrounds the atomized spray and thus lessens the loss of material through evaporation. When dusting is desired a trip lever is raised, completely shutting off the paint supply and allowing the air only to function.

Accurate control of both the air and paint is obtained by means of a trigger. By pulling the trigger the paint flows to the atomizing chamber, is expanded and driven with ample force into the pores of the surface to be covered.

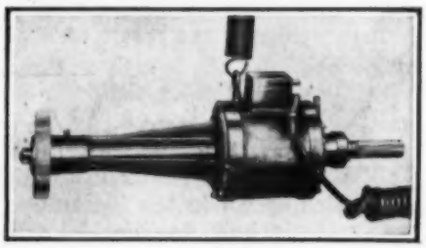
Milburn 3-in-1 Paint Spray

The device is of all-metal construction. A simple bayonet-type lock is used on the container, which is said to be leak-proof. Only three parts are in contact with the paint. The outfit is non-clogging and easily cleanable.

The spray gun is light but rugged and evenly balanced with a natural hand grip for ease in manipulation.

Standard Electrical Tool Co. Swing Grinder

The swing grinder shown in the accompanying illustration is one of a line of five sizes made by the Standard Electrical Tool Co., 1938 West Eighth St., Cincinnati, Ohio. These grinders are especially adapted to surfacing rough castings and cleaning castings of all descriptions. The machines may also be used with canvas wheels for polishing or hand buffing. They can be suspended from a traveler or counterbalanced on a pulley.



Standard Electrical Tool Co. Swing Grinder

The armature shaft is made of 3½ per cent nickel steel and is mounted upon three ball bearings inclosed in dust-proof housings. The motors are especially designed for electric tool service of continuous duty. They are rated at ¼, ½, 1, 2 and 3 horsepower.

USL "Frontier Model" Series 12 Electric Arc Welders

In order to meet the demand for a light, cheap welding set for use in the smaller industrial firms and commercial welding shops, the U. S. Light and Heat Corporation, Niagara Falls, N. Y., developed the "Frontier Model" Series 12 arc-welding set for both 200- and 300-amp. capacity. The 200-amp. model is illustrated.

This type of equipment is furnished in the portable, semi-portable and stationary designs. More specifically,

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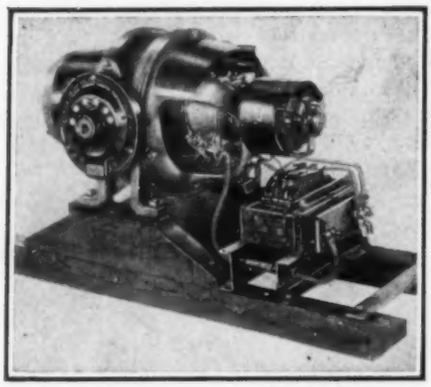


USL "Frontier Model" Series 12, 200-Ampere Arc Welding Set

the motor generator is mounted on wheels, on wooden skids, or is shipped unmounted.

This welder is the result of simplified design of the standard USL welder. The voltmeter and ammeter have been eliminated and the field rheostat calibrated in terms of amperes to take their place. This rheostat is mounted on one side of the generator set, with the starting box on the other side. Twenty-six current adjustment steps are available. With the 200-amp. model the widest range of heats is 50 to 225 amp. and in the 300-amp. model, from 80 to 350 amperes.

The set is light and compact in design. The generator is shunt wound and is separately excited. All flux carrying parts are fully laminated. It is economical to operate, because it is free from all outside current consuming devices, such as resistance grids and carbon piles.

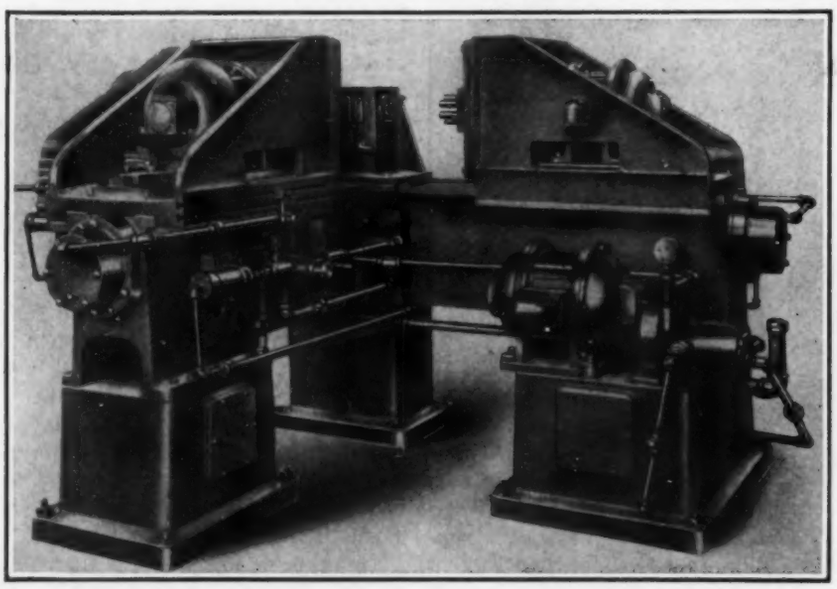
Natco Three-Way Hydraulic Driller

THE three-way Natco hydraulic driller shown in the illustration was recently built by the National Automatic Tool Co., Richmond, Ind. The machine was designed to drill all the holes in the three sides of a transmission case at the rate of 120 cases per hour. The operator unloads and reloads the fixtures, starts the head travel, and the machine then automatically completes the cycle. Both fixtures are opened or closed with a single motion of the clamping lever.

This three-way driller is composed of three duplicate units, grouped around the center table casting. Each unit has its own valves and trip mechanism and can be set individually as to rapid traverse, feed and rapid reverse. The three heads are centrally controlled as to starting and emergency reverse, however, from the one valve at the operator's position.

The feeding rate can be set at any amount from 0 to the rapid traverse rate of approximately 75 in. per min., the feed being limited only by the capacity of the drills. In actual operation this machine has drilled twenty-one holes in the three sides of four castings in one minute. The deepest hole was through a wall $\frac{31}{32}$ in. in thickness with a drill 0.332 in. in diameter.

The machine is compact in construction and takes up a minimum of floor space. It is built in a wide range of sizes covering all kinds of work.



Natco Three-Way Hydraulic Driller, rear view

Sterling Disk Grinding Wheels

The Sterling Grinding Wheel Co., Abrasive Division of the Cleveland Stone Co., Tiffin, Ohio, has developed a full-dimension disk grinding stone to be sulphured direct to the plate.

Several claims are made for this type of disk grinder: Because the disk is thicker, it will last six or more times as long as the usual paper disk, and when it does finally wear out a new one can be put on within 15 to 20 minutes. Because the disk is sulphured in place, it is said that the delay of cleaning the plate is eliminated and that the stone sets in a few minutes. This sulphur bond is said to be very tight.

Bethel-Player Standard Bench Laps

In order to enable toolmakers and machinists to correct errors due to wear in micrometers, snap and limit gages, end rods, gage blocks and parallels, the Bethel-Player Co., Westboro, Mass., has placed on the market a series of bench laps and stands. With this device and suitable holders, angular surfaces such as cutting tools for thread gages and other accurate forms may also be kept flat and at the correct angle with perfect polish.

The device consists of a cast-iron base and a series of circular lapplates, $4\frac{1}{2}$ in. in diam. and of various thicknesses. These plates are lap-finished and are serrated on both sides. They are guaranteed flat and parallel to within 0.0001 in. Each lap is mounted on the top of the base and is clamped by a bolt and knurled nut below. In this way the lap forms a turntable so as to insure equal distribution of the wear over the entire surface of the lap.

The standard equipment comprises a stand with four laps of $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. thickness and one can of abrasive, all contained in a polished

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Bethel-Player Standard Bench Lap on Stand

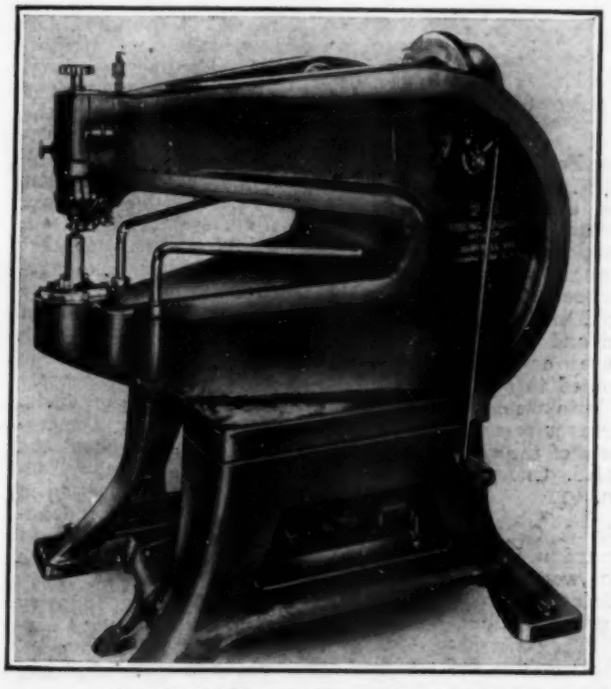
wooden case. Single laps of 4½ in. in diam. can also be furnished separately in a leather case. Larger size laps can also be furnished in diameters of 6, 9, 12 and 18 in. The set of four laps provided as standard give ten different built-up lapping thicknesses for larger gap gages.

Campbell No. 2 B Nibbling Machine

The No. 2 B nibbling machine shown in the accompanying illustration is a deep throat machine made by Andrew C. Campbell Inc., Bridgeport, Conn., for cutting sheet material up to ⅜ in. in thickness. The machine may be furnished for either belt or motor drive. It operates on the same principle as this company's other nibbling machines, previously described.

A pulley 15 in. in diam. by 3-in. face is regularly furnished, and at its rated speed of 350 r.p.m., this machine will cut approximately 26 lineal inches per minute. A 1-hp. motor is required to drive the machine. The depth of throat is 30 inches.

The net weight of the belt-driven model is 4,450 lb. It occupies a floor space of 4 ft. 7 in. by 3 ft. 5 in. It is 5 ft. in height.



Campbell No. 2 B Nibbling Machine

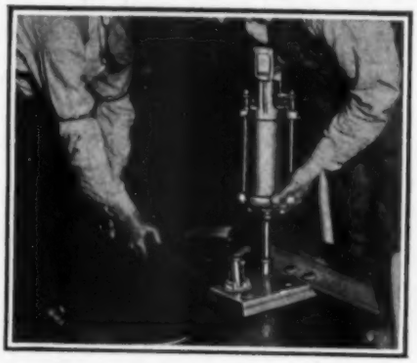
Syntron Type R-2 Electric Riveting Hammer

The Syntron Co., 400 Lexington Ave., Pittsburgh, Pa., has recently added a riveting and metal chipping hammer to its line of drilling and chipping hammers.

This tool, shown in use in the accompanying illustration, operates on the Syntron principle of only one moving part. It embodies, in brief, a reciprocating piston actuated by two twin electromagnets energized from a source of alternating current. By means of a simple and unique system of air cooling, it is claimed that the weight has been reduced to a point never before realized in a portable electric hammer.

Several advantages are claimed for this tool: It is economical in first cost and maintenance, and due to its high efficiency the electrical power consumption is low. It is readily portable, and where d.c. electric power is available a motor generator set, weighing 300 lb., is supplied. This set is mounted on a platform having rubber tired wheels. Where electric power is not available, as in field work or remote locations, a gas-engine driven power plant mounted either on skids or on a trailer, weighing 650 lb., is available. This power plant can also be used to operate electric lights and all kinds of standard portable electric tools, as it generates alternating current at standard voltage. Where alternating current is avaiable, the generator set is not required.

The Type R-2 hammer weighs 10 lb., and has a capacity for driving



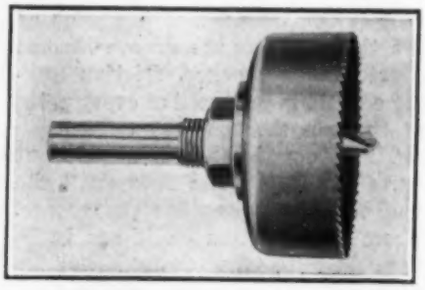
Syntron Type R-2 Portable Electric Riveting Hammer

¾-in. rivets, white hot; ½-in. rivets, cherry color; and ⅜-in. flat-head rivets, cold. It can also be used as a heavy-duty metal chipper.

Black & Decker Hole Saw

The Black & Decker Manufacturing Co., Towson, Md., has brought out what is known as a hole saw for use in cutting holes of large diameter in cast iron, wrought iron, steel, brass, copper and other metals, and wood.

It is designed for use in conjunction with this company's ½- and ⅝-in.



Black & Decker Hole Saw

portable electric drills. The cutter is made of high-quality saw steel, carefully hardened, and is said to be strong and durable. The mandrel is designed to hold a ¼-in. twist drill, which drills the pilot hole and serves as a guide for the saw.

These hole saws are made in two sets: One is for automotive use in cutting holes in instrument boards

Shop Equipment News

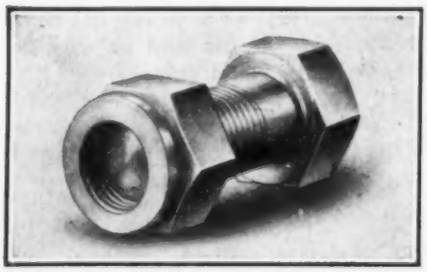
for mounting speedometers, gages and the like, and for general use where holes ranging from ¾ to 3½ in. in diam. are to be cut. The set consists of five saws and two mandrels.

The other set also contains five saws and two mandrels, but is for plumbers and steam fitters. It can be used for cutting holes in floors and partitions, in tanks, soil pipe, bath tubs, sinks and the like.

"Crown" Locknut

The Barty Axle Corporation, Syracuse, N. Y., has developed a line of "Crown" one-piece locknuts, one of which is shown in the accompanying illustration. Each nut is complete in itself, and it can be held securely at any place on a bolt. No lockwasher, cotter pin or other locking device are required.

These locknuts are made by turning an annular groove at the top of



"Crown" Locknut

the nut and then subjecting the piece to compression. This compression of a few thousandths of an inch so decreases the space left at the root of the thread that the pitch of the threads near the groove become shortened and, hence, friction locking contact is produced at every point of the bolt threads they engage.

The Crown locknut is easy to put on, since it is hand free until the end of the bolt reaches the groove. From this position on it has to be wrenched to the desired holding place.

Trade Catalogs

Chain Drives. The Diamond Chain & Manufacturing Co., Indianapolis, Ind., has published a booklet entitled "Rolling the Problems out of Transmission." The application of Diamond roller chains for the transmission of power in the general industrial field is the subject of discussion. Illustrations are used to show the variety of ways in which this chain can be applied to both machinery and motor drives. The bulletin contains twenty pages.

Gears, Standardized. The Boston Gear Works Sales Co., Norfolk Downs (Quincy) Mass., has recently published its general catalog No. 47 on its standardized gears and other equipment. The catalog contains 192 3½x6-in. pages and is well illustrated throughout. Considerable space is given to gears followed by a section devoted to chains, both of the roller and silent type, and sprockets. The speed reducing units appear next, followed by miscellaneous transmission equipment such as couplings, pulleys and the like. The catalog is indexed.

Grinding Machines, Car-Wheel. The Norton Co., Worcester, Mass., has published a 28-page booklet on the subject of car-wheel grinding. The advantages of this method of truing wheels on Norton machines are brought out by means of eighteen questions and answers. Test data are presented to indicate the time consumed in this operation. Other cost figures are also given. The booklet is well illustrated throughout.

Hammers, Forging. The Nazel Engineering & Machine Works, 4047 N. 5th St., Philadelphia, Pa., has published a leaflet entitled "Cutting Forging Costs." It illustrates some of the work done on the Nazel air driven forging hammers.

Packing, Rod. Greene, Tweed & Co., 109 Duane St., New York, N. Y., has published a booklet entitled "The Door to Economy." The various grades of piston rod and pump packing made by this company are brought out. A reprint from an article in *Power* on "The Selection of Piston Rod Packing" is also included. Ratchet wrenches are listed in addition. The booklet is illustrated and contains sixty 3½x6-in. pages.

Speed Reducers. The Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has issued catalog No. 300 on its IXL Hygrade worm gear speed reducers. The catalog contains twenty-four 8½x11-in. pages and is well illustrated with halftones, including several cross-sectional views. The various units are shown and the constructional features are explained. Several tables are presented to aid in selecting the correct unit to meet the service and horse-power requirements. Complete dimensional data of the various units are also included. One page is devoted to lubrication.

Wood Miller. Wadkin & Co., Leicester, England, has issued a booklet describing its Semi-Auto wood miller. This publication contains fifty-six 8x10½-in. pages and is profusely illustrated with photographs. The construction and operation of this machine are explained in detail and many examples of its use are given, each example being illustrated by a photograph. The examples are largely of pattern work. The machine is marketed in this country by Chas. A. Streling Co., 155 East Kirby Ave., Detroit, Michigan.

Experts Stress Economy of Oil Locomotive

Power experts and railway economists who have been studying the performance of the oil-electric locomotive on various railroads declare this type of motive power imposes a much smaller burden on tracks and roadbed than does the steam locomotive.

In an authoritative book on Diesel engines, David Louis Jones says that the oil-electric locomotive provides uniform, continuous torque at the wheels, which results in less wear on the tracks and provides higher tractive effort at starting and slow speeds, on much lighter axle loads. The expense of rail and roadbed maintenance on 250,000 miles of right-of-way in the country runs into hundreds of millions of dollars a year and railroad systems are trying in every way to reduce this cost.

In operating the oil-electric locomotive there is no jerking, tugging and slipping of wheels at the start, says Mr. Jones. This is so because of the nature of the power transmission system, which enables the full effect of the driving engine to be utilized at all speeds.

Swedish Machine Industry Had Good Year

The year 1926 was favorable to the Swedish mechanical industry, according to a report to the Department of Commerce. The export value of the group "vessels, vehicles and machinery" during 1926, according to official statistics, amounted to 129,400,000 Swedish crowns ($34,627,440) while the same figure for 1925 was only 107,000,000 crowns ($28,729,500). The percentage of unemployed was somewhat lower than in 1925 during the first part of the year, and somewhat higher than that figure during the second part of the year. Competition from foreign manufacturers remained severe throughout 1926, especially with regard to payment terms. In some countries governmental export credit systems were established, which had adversely influenced the sale of Swedish products.

The tool industry experienced uncertain conditions, although old stocks were finally exhausted. The many factories which took up tool production in Sweden during the war have now abandoned this work, and thus only the old tool makers with their well known brands remain.

The Swedish ball bearing industry has been working at full capacity during the past year, and sales have increased considerably in spite of strong foreign competition.

NEWS OF THE WEEK

Proceed With Program for Aircraft Defense

Preparations are now being made by Army Air Corps officers to enlarge the nation's aerial defense units as provided for in the Army Appropriation Bill signed recently by President Coolidge. This measure sets aside $21,891,000 toward the expansion and support of the Army Air Corps and marks the first step toward transforming the first increment of the nation's army air program from plans on paper to plans in the air.

The outstanding feature of the bill is authorization for the purchase of 590 planes, at a cost of $12,005,000. Of these planes, 508 are for the direct use of the Army Air Corps and the remaining 82 for the National Guard.

Those for the Army fall into the following subdivisions: 258 training planes, 94 pursuit, 61 observation, 45 attack, 25 bombardment, 9 cargo planes and 16 planes of various service test types. Contracts for the construction of these new aircraft will be let at the earliest possible opportunity and as soon as those in charge of aircraft procurement have decided upon the types of ships to be used.

Another important provision in the bill is that which increases the Army Air Corps personnel during the coming fiscal year from 912 to 1,100 officers; and from 8,760 to 10,008 enlisted men.

Other items in the Army Appropriation Bill which directly benefit the Air Corps, follow: $2,200,000 for experimental and research work; set aside $200,000 for the purchase of helium from the Bureau of Mines; appropriate $275,000 for lighter-than-air equipment, and $1,062,935 for technical construction and improvements at Air Corps stations.

Industrial Machinery Exports Increase

The year 1927 started propitiously, from the standpoint of industrial machinery exports, for shipments during the month of January exceeded, with a single exception, those for any month since the year 1921. Exports of industrial machinery during January amounted to $14,946,842, as compared with $13,434,223 for the corresponding month of 1926.

The largest export gains during January occurred in power-generating machinery, metal working machinery, and in miscellaneous industrial machinery. In the power-generating group the greatest activity was manifested in shipments of steam engines, exports rising from $729,328 in January, 1926 to $1,120,302 for January, 1927. Shipments of metal working machinery amounted to $1,847,560, or nearly $191,000 more than the total for January, 1926. Exports of this class of machinery during the two periods under discussion have been as follows: January, 1926: power-driven, $1,206,125; other metal working machinery, $460,788. January, 1927: power-driven, $1,495,455; other metal working machinery, $352,105. Exports of external cylindrical grinding machines rose from $53,646 to $139,851; forging machinery from $71,578 to $105,875; and foundry and moulding equipment from $42,695 to $134,138.

Exports of miscellaneous industrial machinery reached the large total of $5,262,437, as compared with $3,550,081 for the corresponding month of 1926.

High Costs Hinder Swiss Machine Industry

Machine production in Switzerland continues to be limited by high costs of labor and materials, according to a report to the Department of Commerce. The former disadvantage became less important during the past year as the stiffening of the Latin exchanges caused labor costs of neighboring competing states to approach more nearly those obtaining in Switzerland. On the other hand the adoption of a nine-hour day in Italy and labor conditions more favorable to employers in certain other countries were a handicap which will continue during the period ahead. Other limitations of the outlook are the popularity of protectionism in the chief markets for Swiss machines—including developments of this sort in the recent British Imperial Conference; and the continued absence of demand on the part of Russia. Material costs showed an encouraging downward trend in the first half of 1926, reaching in some lines levels lower than before 1914, but the tendency during the latter half of the year and at the opening of 1927 was toward higher prices.

The outlook for the various branches of machine manufacture is irregular. During the first half of the past year activity for all branches was satisfactory due to good orders, part of which were carried over from 1925. Through the last half of the year conditions were less favorable and continued to be so at the opening of 1927. Swiss steam locomotive construction during 1926 was less satisfactory than in 1925, a condition attributed to a falling off in world consumption in this line and increased competition.

On the whole the prospects for 1927 for machinery manufacture are not brilliant. Under present materials and labor costs, hours of labor and the current high tariff rates, the Swiss manufacturer finds it difficult to hold—or regain—his position in foreign markets.

Personal Service Leads in Income Capacity

Although only about 37 per cent of the entire population of the United States was gainfully occupied in 1925, according to an estimate made by the National Industrial Conference Board, more than 73 per cent of all the personal income reported in 1924 was derived from personal service or business activity. Out of a total of $29,128,000,000 of personal gross incomes ranging from $1,000 net a year upwards in 1924, 46.2 per cent consisted of wages and salaries or commissions, 27.3 per cent of incomes derived from personal business activities in trade, commerce and farming, and only 26.5 per cent represented returns on investments.

Even in the ranks of the very wealthy, that is of persons with annual net incomes ranging from $500,000 a year upwards, business activity looms large, inasmuch as practically 40 per cent of the combined gross income of this group is derived from business activity. It is likewise significant that those with net incomes ranging from only $1,000 up to $3,000 have sufficient money saved or invested to have received a total of $1,570,000,000 in 1924 in shape of interest, rent or dividends, making an average of about $346 per return for the year. Those with net incomes of $500,000 a year or more in 1924 received as returns on their investments a total of $225,237,417, or an average of about $710,528 for each of the 317 making up this group.

Contrary to a popular impression, by far the largest bulk of investments is in stocks, and dividends from stocks loom largest in the highest income groups, while in the lower income groups, that is among those with incomes of less than $5,000 a year, real estate, bonds and savings accounts are the favored forms of investment.

Aeronautics at Buffalo

The first national meeting of the Aeronautic Division of the American Society of Mechanical Engineers is to be held on April 26 in Buffalo, N. Y. The advantage of that city with its number of aeronautic plants and its central location will greatly aid in making the meeting interesting and successful. The invitation of the Buffalo Section and its hearty co-operation is molding the meeting program and arrangements quickly into form. A large committee of local members is pushing the arrangements. Among them are L. D. Warrender, Chairman; S. S. Lowe, W. M. Dollar, W. H. Ahlers, and C. A. Booth. This meeting promises to stimulate members in the Aeronautic Division to even greater progress in their field.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THE newspapers continue to tell of a persistent demand for investments that since the first of the year has absorbed new securities at the average rate of nearly $150,000,000 weekly; of a new record in Stock Exchange sales during February, when an average of more than 2,000,000 shares changed hands daily at prices that advanced steadily and reached the highest of the year on the last day of the month; of savings bank deposits that show phenomenal gains; of life insurance accumulations that are amazing in their growth; of advertising whose cost seems fabulous when compared with what was spent for publicity fifteen years ago; of a national income that is now put at about ninety billion dollars and has increased 40 per cent since 1921; of car-loadings and bank clearings that bespeak an activity that is without precedent; of a demand for luxuries, travel and amusement and a munificence in philanthropy that argue the possession of inexhaustible wealth.

But they also tell of many rural bank closings; of more numerous business failures than in any year since 1922; of New England cotton mills that are being junked because they have become unprofitable; of a threatened strike among the bituminous coal miners, who claim they cannot live on the wages paid them; of the agricultural depression which has become a major political issue; of an extension of installment credit against which from five to eight billions of unearned income has been mortgaged; and of a "crime wave" which is said to cost sixteen billions yearly in losses, waste and preventive effort.

Facing conditions that seem so paradoxical, it is not surprising that Senator Walsh of Massachusetts should have asked that a committee of fifteen of his colleagues be appointed to investigate our alleged prosperity and determine whether it is real or illusory, and whether as he alleges it is confined to certain classes and is not shared by the agriculturists and part of the industrial workers of the country.

But it is doubtful whether a Senate committee or anyone else can answer the questions thus propounded, for prosperity is a state of mind as well as a state of facts and it is likely to persist as long as people are willing to spend even though their expenditure involves borrowing or an anticipation of their income by buying on credit. Therefore, the ease of money and the expansion of credit for which the Federal Reserve System gives opportunity are factors that should never be lost sight of in appraising the situation. They are of tremendous importance psychologically as well as physically. In its annual report made public last week the Federal Reserve Board says that the amount which the member banks would be entitled to borrow from the Reserve Banks on the basis of their present assets exceeds 7½ billion dollars. Their actual borrowings by the last report were only 434 millions. The knowledge that credit can be obtained when wanted is almost as important as the entry by which a given sum is put at the disposal of the borrower.

And there is nothing to indicate any shortage or contraction of credit in the near future, it seems safe to assume that the track is clear for some months ahead.

In the major industries orders and production are undeniably gaining and the slack in employment that existed in some centers is being absorbed. February statistics show an increase of about 5 per cent in daily average iron and steel output. But the optimism that this might arouse is diminished because production exceeded new bookings, despite heavy buying in the last week, and stocks of semi-finished steel increased during the month.

Most automobile manufacturers report heavy sales and capacity or near capacity production. But a few important companies are less fortunate and while the increase in output over the winter slump is encouraging the industry is still below last year's level.

In building the available facts indicate a slight recession as compared with a year ago but it is not yet nearly as severe as some of the prophets of depression predicted.

The textile, more particularly cotton and silk goods, and the tire industries continue, as heretofore, the brightest spots on the business map.

The stock market had one of its "bad days" last Wednesday. Stocks like persons are subject to faintness in the rarefied atmosphere of the high altitudes and such attacks must be looked for. The industrials are upheld by easy money and their course depends upon the trend of business. Of the rail group it is in order to point out that the prices of some of them discount consolidations that have not yet been made and may not be consummated. The Transportation Act was passed in 1920 but we have had no consolidations yet save those formalities by which roads have absorbed subsidiaries which they had long owned and which had lost their separate identity.

These are the high lights of a picture in which it must be admitted each man can see according to his own liking. The foreign news on balance neither brightens nor obscures it greatly. But on the whole the background of credit abundance gives it a dominantly cheerful tone and the stage directions do not yet call for the exit of good times.

WHAT'S DOING IN INDUSTRY

THE MOST encouraging thing that can be said about the present market for machinery and machine tools is that it is holding up to a steady volume of new business, even though that volume is not as great as is desired, or as had been expected. The demand is spotty, but there are many signs of improvement.

DETROIT reports a decided change for the better, with automobile manufacturers again calling for production tools. Manufacturers and agents in the Cincinnati district admit a slight increase in sales, with inquiries pointing to an upward trend in the next few weeks. No perceptible improvement is noted in Chicago, but there is some good railroad business in prospect.

IN CANADA, machinery dealers are enjoying a profitable season, extensive railway, steel and waterpower projects furnishing the bulk of an increased business. Conservative buying in the New England territory is keeping up a fair volume. Little of the expected improvement in the New York market has materialized.

IN THE GENERAL business picture the background of credit abundance gives it a cheerful tone and there are no apparent indications of a curtailment of present prosperity.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

Conservative, hand-to-mouth buying prevailed in the past few weeks, according to the judgment of managers of sales in some of the principal machinery building industries in New England. This conservatism is regarded as a satisfactory condition and keeps in prospect the period of more liberal buying. A Hartford industrial publication points out a condition of the metal industry of the city showing an increase of 700 expert mechanics in local industries for the year, and forecasting further increase through the operations on the Wasp motor by the Pratt & Whitney Aircraft Co. The reorganization of the capital structure of the Billings & Spencer Co. progresses, and it is possible that the sale of the plant may shortly be negotiated. Recent business suspensions are of no moment, concerning only small employers.

Railroad buying continues to be conspicuous in the business prevailing. Builders of textile machinery report a slightly improved condition among Northern manufacturers and good business from the South.

Manufacturers of chucks and dies report an improvement in the orders for export delivery.

NEW YORK

It is too early in the month to say whether or not the volume of sales that had been predicted will actually materialize. The first ten days of the month have brought little improvement, as orders continue for small quantities and no large lists have appeared. Buying against old lists is slow, but it is again reported that the B. M. T. is about to close on the extensive requirements for its repair shops at Coney Island. Desultory demand continues from the General Electric Co., Westinghouse and the New York Central and the Lackawanna railroads.

The equipment ordered in this market in the past week shows a wide variety of demand — lathes, jig borers, grinders, presses and steel fabricating machinery. Among the reported purchasers are—Crocker-Wheeler, Otis Elevator Co., Boye & Emmes, Union Manufacturing Co., Standard Tool Manufacturing Co., Mechanical Specialties Co., the Virginia Electric and Power Co., and the Monongahela R.R. The market for used machinery continues to be governed by a demand that is inspired by low prices for equipment in fair shape.

The Niles-Bement-Pond Co. has received an order from the Japanese government for a quantity of machinery to be used in one of its arsenals. This machinery will be manufactured by the Pratt & Whitney Division of the company, at Hartford, Conn. The total amount of the order is not stated, but it is understood to run into six figures.

CHICAGO

With an exception here and there, machine tool houses report business as showing no perceptible improvement in the last week. The exceptions apply to such concerns as have been dealing with inquiries received some time ago, and which have developed into actual transactions. While there are those in the machinery industry who are optimistic with reference to the business expected during the remainder of March, the greater number of dealers frankly express themselves as not looking for any material improvement in the market before the beginning of April.

General industry, which for some time past has furnished the major part of the business in machine tools, has receded somewhat, production being reported as below normal for this time of the year. The lessening in output, however, is believed to be only temporary. Railroad buying is still confined to small lots, but reports are to the effect that two or three Western roads will shortly be in the market with lists that should stimulate trade materially.

Inquiries continue to be received in such satisfactory number and are of so varied a character that dealers in used machinery are inclined to believe that the present inactivity will be of short duration.

DETROIT

Several sizeable orders for new equipment have served to improve temporarily the market for machinery and machine tools in the Detroit district during the past week. Conditions are not as good as had been expected but the tendency is for more buying on the part of automobile manufacturers.

At present the rumors that changes are imminent in the body building business has resulted in much conjecture whether extensive programs of additions to equipment will be carried out soon or not. It is known that both Briggs and Murray, mentioned in connection with a merger, are contemplating some large orders for machinery.

Among the automobile plants Cadillac and Oakland are buying singles machines to bolster up the motor assembly line. Buick and Chevrolet have been buyers during recent months and still are placing orders for tools here and there. Nothing of consequence has developed at Packard, but at the Continental Motors Corporation several orders have been reported. At the Wilson plant in Pontiac the activity is the highest it has been for more than a year, and several new machines have been built.

General manufacturing is picking up in Detroit as is demonstrated by the figures announced by the Employers Association which show more men at work than for any time during the past three months.

CANADA

Machine tool manufacturers are well employed at present and the outlook for the next three or four months at least, is highly promising. Railway equipment buying continues to be an important factor, and most branches of the metal-working industry are beginning to feel the benefit of this business. The latest orders from the Canadian National Railways have been placed with the Montreal Locomotive Works and the Canadian Locomotive Co., each company having received an order for 20 locomotives of the 4-8-4 type. Another important announcement is that one hundred new street cars will be purchased shortly by the Toronto Transportation Commission, at an expenditure of a million and a half dollars.

The iron and steel industry has been slowly gathering headway. Orders on hand have been sufficiently large to allow of a fairly consistent scale of production. The demand for steel from the railway equipment and construction industries has been active since the beginning of the year. Manufacturers of heavy machinery for paper-making and water-power development are unusually busy.

Production of automobiles during January amounted to 15,376 cars, an increase of 8,224 units over the December output. Of the total January output, 49 per cent were produced for export and the balance were intended for sale in Canada.

CINCINNATI

The great majority of machine tool manufacturers in the Cincinnati district report an increased demand in the past week, not very large in most cases, but enough to be encouraging. Selling agents report a general market improvement and state that the lapse of time between the receipt of inquiries and the placing of orders is showing a tendency to grow shorter.

While the week's business showed an increase in total sales, there was no manifest tendency on the part of buyers toward the placing of large orders, and bookings were almost entirely confined to single tools and replacements. The orders received were well scattered over the country and the purchases were well diversified in the matter of sizes and types of tools.

A few orders for single tools and replacements were placed by railroads and concerns in the automotive industry. Several tools were bought by producers in the Southwestern oil field. Local machine tool manufacturers made a few purchases, to replace present equipment.

Inquiries came in freely during the week, from all sections of the country and from all kinds of users. The majority of these were in regard to single tools and replacements. A great many of the inquiries show that the discarding of obsolete tools is under consideration by users in various lines.

INDIANAPOLIS

While business shows some expansion over the first two weeks of February, the general total is hardly what the trade expected and there are many soft spots that will have to be built up before a normal volume is reached.

The best buyers of machine tools are the automobile and allied industrials. Local automobile factories are increasing their production and executives declare that the prospects seem bright. Several new installations are being made and a considerable volume of old equipment is being replaced. The same is true of the accessory factories here. Demand for special machinery for body plants also is good and promises to become better as the season advances.

A number of inquiries are being received from contractors in both the road and the building construction business for special equipment. Road building machinery promises to sell exceptionally well this year, judging from the inquiries.

A decline in the volume of coal machinery sold in this section is reported, due to failure to reach an agreement at Miami The Indiana operators are preparing for a prolonged strike and have curtailed all expenditures to emergencies.

Some increased interest is evidenced by the railroads. Given some good weather, the railroads will begin their spring repair programs in earnest.

Foremen Meeting at Cincinnati

The fourth annual convention of the National Association of Foremen will be held at Cincinnati, Ohio, on Saturday, May 21. The entire day's program will be held on the grounds of the Cincinnati Zoo. The morning will be occupied with four talks on the main subject "The Foreman as a Business Manager of His Department." The afternoon will be taken up with entertainment and informal business matters. In the evening a nationally known speaker will talk on the subject "Big Business Demands Big Men."

A barbeque dinner will be served at noon and a banquet in the evening. An invitation is extended to all foremen and superintendents in the industries of the United States and to any others interested in better foremanship. Registration should be sent to E. H. Tingley, secretary, 1249 U. B. Building, Dayton, Ohio.

Fewer American Cars Assembled Abroad

The sale of American cars assembled in foreign countries during 1926 was less by more than 5,000 compared with 1925, according to a report compiled by the automotive division of the Department of Commerce. Reports received from twenty-two assembling plants in 1926 show a total sale during the year of 174,929 cars of American type. During 1925 seventeen foreign branch plants of American automobile companies accounted for the assembly and sale of 180,350 cars, while in 1924 ten such plants then in operation recorded sales totaling 142,346 units.

Attention is called in the report to the fact that the above foreign-assembly sales figures though comparable are not all inclusive since it is known that many cars of American design during recent years have been assembled by local foreign dealers whose production and sales reports are not received.

Foreign Automotive Information

Total production of passenger automobiles in Great Britain during 1926 numbered 158,699 cars, valued at £43,161,945, as compared with 133,500 cars with a value of £41,566,000 in the preceding year, according to an unofficial survey made public in London. The British output of passenger cars in 1924 totaled 107,000 valued at £36,500,000. This reported increase in passenger car production of nearly 19 per cent in quantity and 4 per cent in value over that of 1925 is especially interesting in view of the industrial depression that existed in the United Kingdom during the past year. According to the figures the 1926 output marks the peak of a gradual increase in output which has been recorded since 1922.

The establishment of an assembly unit in Copenhagen by the French automobile producer, Citroen, is indicated in reports that that concern has acquired a factory site in the South Harbor of the Swedish capital. The site which is reported to have been purchased by Citroen contains 18,000 sq.m. and it is the intention of the French company to erect a single story factory which will have a capacity sufficiently large to supply the Scandinavian and Baltic countries with its automotive products.

American automobiles made marked headway in Bavaria during 1926. The introduction of new American models caused the sales of French cars to fall markedly. The prospects for 1927 in the Bavarian automobile industry are especially favorable and a banner year is predicted by dealers. Bavaria has a population of about seven million people and as there is approximately only one passenger car for over three hundred and fifty persons, it should afford an attractive market for American exporters.

The twenty-first international automobile salon of Paris will be held this year in the Grand Palais at Paris, from Oct. 6 to 16. The exposition will be reserved to touring cars, cycle-cars, motorcycles, parts and accessories, tires, lubricants and carburants. No truck salon will be held this year following the automobile display, but such a salon may be staged at some other time during the year. The secretarial offices for the 1927 exposition are now opened at 51 rue Pergolese, Paris, France.

The Bureau of Foreign and Domestic Commerce has issued a warning to American manufacturers to guard against a proposition from certain foreign publishing concerns, offering to publish without charge articles in their trade publications. It has been found that this scheme results in the charging of exorbitant prices for illustrations and engravings. It has been found that these publications have no standing in their fields. The Bureau would be glad to advise manufacturers on this matter.

Aeronautical Notes

Assistant Secretary of Commerce for Aeronautics, William P. MacCracken, has announced that the regulations requiring the licensing of aircraft and airmen has been changed to give two more months for submitting of applications. Under the present regulations aircraft and airmen subject to the regulations may continue to operate without a license until July 1, if the application for the license is filed with the Secretary of Commerce prior to March 1. The closing time for applications has been extended to May 1.

That the establishment of a commercial air service in South Africa seems assured for the near future is contained in the announcement that capital for such an enterprise has been raised in England and the United States.

The initial route of the proposed service will be between Johannesburg and Durban with other cities, Cape Town, East London, Port Elizabeth, and possibly Walvis Bay. A sum of £35,000 is reported already to have been subscribed. It is intimated that Junker, all-metal, commercial monoplanes will be used. In addition to passenger traffic the promoters are negotiating to obtain a government contract for the carriage of mails.

John L. Hosch, aeronautical engineer for the Department of Commerce, has returned from an extended tour of inspection of various aircraft factories in the United States. The factories visited were those of Pitcairn Aviation, Inc., Philadelphia; Travel Air Manufacturing Co., Inc., Wichita, Kansas; Swallow Airplane Manufacturing Co., Wichita, Kansas; Alexander Aircraft Co., Denver; Lincoln Standard Aircraft Co., Lincoln, Nebraska. This tour was made for the purpose of acquainting aircraft manufacturers with the construction reqirements of the Aeronautics Branch of the Department of Commerce, and also to acquire general information as to the methods used in each factory.

The Pitcairn Aviation Co., of Philadelphia, Pa., was the only bidder on the proposed New York to Atlanta commercial air mail route. The concern agreed to carry the mails for three dollars a pound, including equipment. It will furnish six planes at once if given the contract, and two to be held in reserve. Harold F. Pitcairn is president of the concern.

Flying over this route will be done entirely at night. The tentative schedule arranged provides that the plane shall depart from New York at 9 p.m. each evening, reaching Atlanta at 6 a.m. the next morning.

Prizes for Aircraft Supremacy

Prizes established by the French Government in 1926 have been distributed to several French firms. The sum of 50,000 francs was given to the Breguet Co., manufacturer of airplanes, and the Hispano-Suiza Co., manufacturer of engines, for the record-breaking, non-stop flight from Paris to Djask. A prize of 25,000 francs was given to the Bleriot Co., manufacturer of the plane which established a new altitude record of 7½ miles. A prize of 10,000 francs was given the Rateau Co., for the turbo-compressor used in altitude flights. Prizes established for speed records with airplanes and seaplanes, and for endurance flights, were not awarded.

G. E. Awards

A young woman who devised better methods in a well-established manufacturing process, a young man not yet 20 years old who by construction of a simple device solved a problem which had long been troublesome, and a man who for the third successive year devised improved equipment are included in the list of twenty-seven employees of the General Electric Co. who were awarded Charles A. Coffin Foundation certificates of merit for their outstanding services toward the increase of the company's efficiency or progress in the electrical art during 1926. With each certificate went four shares of General Electric common stock. One-third of the awards were to workmen, two to foremen, eight to engineers, five to commercial men, and three to administrative employees.

The Charles A. Coffin Foundation, which makes the awards, was founded by the General Electric Co. in 1922 in recognition of the services to the electrical industry of the late Charles A. Coffin, first president of the company.

Obituaries

E. E. Jamieson, assistant superintendent of the Jones & Laughlin Steel Corporation's plant at Woodlawn, Pa., died on Feb. 25.

Hugh Melrod, president and owner of the Porter Machine Co., of Hatfield, Mass., died there on Feb. 22.

Edgar S. Robinson, vice-president of the Alloy Steel corporation, died on Feb. 26. During the World War, Mr. Robinson was in charge of construction at the Newport News, Va., naval training station.

T. S. Homans, engineer in the experimental department of the Intertype Corporation, Brooklyn, N. Y., died on Feb. 26. Mr. Homans was a member of Sub-Committee No. 5, of the A.S.M.E. committee on shafting. Sub-Committee No. 5 is now at work on the standardization of Woodruff keys.

Julius O. Kaiser, who for many years has been a familiar figure around the Engineering Societies Bldg., in New York, died at his home in Dover, N. J., on Feb. 4. He had been injured by an automobile a few days before his death.

Albert Ball, chief mechanical engineer of the Sullivan Machinery Co. for nearly fifty years, died at his home in Claremont, N. H., on Feb. 7, at the age of 91 years. Mr. Ball was a man of unusual inventive faculty and keen mechanical sense. He is credited with the development of several mechanical inventions.

Business Items

The New York office of B. F. Sturtevant & Co., of Hyde Park, Mass., has moved into the Graybar Bldg., on Lexington Ave.

The Burke Electric Co., of Erie, Pa., announces the removal of its Pittsburgh sales and service offices to 2124 Farmers Bank Bldg. W. S. Wallace continues in charge.

The Lit-War Co., recently formed at Jackson, Mich., has opened a manufacturing plant and will produce a line of special automotive tools. The company is headed by I. W. Warden, manager of the Wellston Manufacturing Co., and Edward and Fred Litter, formerly operating a machine shop in Columbus, Ohio.

The Holland Maid Co., of Holland, Mich., announces the reorganization of its administrative and financial control. The name of the company has been changed to the Vac-A-Tap Co., and the officers of the old company have taken over control. S. R. McLean has been appointed general manager.

The Climax Engineering Co., of Clinton, Iowa, has completed arrangements with the Koehring Co. Associates, 50 Church St., New York, to handle the sale of Climax engines, power units and accessories for export exclusively in the following countries: Argentina, Columbia, Italy, Panama, India, Philippine Islands, Japanese Empire.

The Shepard Electric Crane and Hoist Co., of Montour Falls, N. Y., has purchased from the General Electric Co., the entire Sprague electric hoist and winch business. This includes the right to manufacture and sell all the hoist products formerly made by the General Electric Co. The Sprague Electric Hoist Division of the Shepard company has been established in the New York office, 30 Church St., in charge of N. A. Hall, who was for many years associated with the hoist department on the General Electric Co.

The Foote Bros. Gear and Machine Co. of Chicago, announces the following additions to its distributing organization: The Interstate Machinery and Supply Co., 1006 Douglas St., Omaha, Neb., has been appointed representative in Omaha, the eastern half of Nebraska and the western portion of Iowa. W. L. Hutcheson, 201 E. California St., Oklahoma City, Okla., has been appointed for Oklahoma City and the northern half of Oklahoma. The Nashville Machine and Supply Co., 123-135 Third Ave., North, Nashville, Tenn., has been appointed distributor for Nashville and the central part of Tennessee.

Personals

FRANK J. DONNELLY has joined the New York office of the Botfield Refractories Co., of Philadelphia. He will cover the New Jersey territory.

JOSEPH G. WORKER has been appointed general sales manager of the American Engineering Co., of Philadelphia. He has been assistant to the president of the company.

WILLIAM R. WEBSTER, president of the Automatic Machine Co., and vice-president of the Bridgeport Brass Co., Bridgeport, Conn., has been appointed a member of the main research committee of the American Society of Mechanical Engineers.

CHARLES E. SCOTT, vice-president and general manager of the Precision Gauge and Tool Co., of Detroit, has purchased the controlling interest in the company. He is also president of the Scott-Pierce Motor Co., of Detroit.

ROY D. CHAPIN, chairman of the board of directors of the Hudson Motor Car Co., has been elected president of the Automobile Chamber of Commerce. He succeeds Col. Charles Clifton, who had held the office continuously for nearly twenty-five years.

CHARLES H. WIGGIN, consulting mechanical engineer for the Boston & Maine R.R. Co., Boston, Mass., has resigned his position after 45 years of service.

J. S. HOFFMAN is now associated with the Foster Machine Co., of Elkhart, Ind., as sales engineer. He has been assigned to the Detroit territory, working in connection with the company's agent, the Strong, Carlisle & Hammond Co. Mr. Hoffman was formerly connected with the Detroit Machine Tool Co.

IRA D. GROVE, formerly associated with the Landis Tool Co., the Landis Machine Co., and the Lees-Bradner Co., has become a member of the firm of the Commercial Tool Co., of Cleveland. Mr. Grove will handle that phase of the company's business having to do with special machinery and its application.

GEORGE E. ROBERTS, vice-president of the National City Bank, has been elected a member-at-large of the Engineering Foundation. Mr. Roberts succeeds Elmer A. Sperry, gyroscope inventor, and will serve three years. Mr. Roberts is one of three members-at-large, the others being A. C. Dinkey, president of the Midvale Steel Co., and Dr. A. D. Little, of Boston.

E. A. MULLER, general manager of the King Machine Tool Co., of Cincinnati, has been elected president of the Cincinnati branch of the National Metal Trades Association. Other officers are: A. B. Breeze, vice-president; J. E. Mills, treasurer; and H. A. Feldbush, secretary. George Schiele, George A. Seyler and Harold Leblond are members of the executive committee.

Calendar of Local Meetings

National Association of Cost Accountants

Boston Chapter. March 17. "Cost Analysis as a Means of Detecting Waste in distribution Costs," by W. B. Castenholtz.

Buffalo Chapter. March 24. "Accounting Problems in the Operation of Standard Costs," by F. L. Sweetser.

Chicago Chapter. March 17. "What Standard Costs Can Do for the Production Department," by H. M. Tompkins.

Detroit Chapter. March 24. "Cost Accounting for Automobile Bodies," by L. D. Crusoe.

Erie Chapter. March 21. "Mechanical Aids to Cost Accounting."

Hawaii Chapter. March 28. "Home Industries for Hawaii," by George Bustard.

Kansas City Chapter. March 21. "Merchandise and Stores Control by Lots — Method of Handling Mechanical Appliances Demonstration."

Milwaukee Chapter. March 17. "Materials Control," by Lawrence G. Regner.

Philadelphia Chapter. March 18. "Operating Ratios and Capital Turnovers as Found in Various Lines of Business."

Pittsburgh Chapter. March 16. "Manufacturing Budgets," by D. C. Lowles.

San Francisco Chapter. March 28. "Accounting and Statistical Control of Industry—Executive Use Thereof."

Scranton Chapter. March 22. "Optional," by C. M. Finney.

Utica Chapter. March 21. "Wage Payment Plans and Bonuses."

Society of Automotive Engineers

Southern California. March 11. "Six-Cylinder Engines for Trucks," by Ethelbert Favary.

Metropolitan. March 17. "Trucks," discussion by chief engineers of several truck manufacturing companies.

Washington, D. C. March 18. Air Transport Dinner—"Air Transport in Europe," by Major Lester D. Gardner.

Detroit. March 24. "Artificial Leather and Rubberized Products," by E. H. Nollau and Mr. Nickowitz.

Forthcoming Meetings

American Society of Mechanical Engineers. Regional meeting, Kansas City, Mo., April 4 to 6. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

American Gear Manufacturers Association. Eleventh annual meeting, Hayes Hotel, Jackson, Mich., May 12 to 14. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

National Association of Purchasing Agents. Annual meeting and "Informashow" at Grand Rapids, Mich., June 6 to 9. W. L. Chandler, secretary, Woolworth Bldg., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

National Machine Tool Builders' Association. First exposition of machine tools, at the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, chairman of the exposition committee. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Bldg., Cincinnati. Roberts Everett, manager of the exposition, 1328 Broadway, New York City.

The Weekly Price Guide

Rise and Fall of the Market

MATERIALS and supplies used in the metal working industries have developed definitely firmer price tendencies during the last two weeks. There is appreciable hardening of the market for coke and pig-iron in the South and West, while demand continues active for steel structurals, plates, wire products, bolts, nuts, rivets, and other shop supplies. Bars, shapes and plates hold firmly to the Pittsburgh mill quotation of $190 per 100 lb. on ordinary tonnages and $2 for small lots. Prices are higher than a week ago in blue annealed and galvanized steel sheets, fabricated brass and copper, solder, and non-ferrous metal scrap. Slight declines occurred at the principal centers in black steel sheets, wiping cloths, and linseed oil.

(All prices as of Mar. 4)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20@2.30	3.50	3.15	3.89
No. 12	2.25@2.35	3.55	3.20	3.94
No. 14	2.30@2.40	3.60	3.25	3.99
No. 16	2.40@2.50	3.70	3.35	4.09
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.25	4.15
No. 22	2.85@2.95	3.90	3.40	4.30
No. 24	2.90@3.00	3.95	3.45	4.35
No. 26	3.00@3.10	4.05	3.55	4.45
No. 28	3.15@3.25	4.20	4.70	4.60
Galvanized				
No. 10	3.05@3.15	4.10	3.95	4.40
Nos. 12 to 14	3.15@3.25	4.20	4.05	4.50
No. 16	3.25@3.35	4.30	4.15	4.60
No. 18	3.40@3.50	4.45	4.30	4.75
No. 20	3.55@3.65	4.60	4.45	4.90
No. 22	3.60@3.70	4.65	4.50	4.95
No. 24	3.75@3.85	4.80	4.65	5.10
No. 26	3.95@4.10	5.05	4.90	5.35
No. 28	4.20@4.35	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼, 7.85c.; ⅝ to ½, 7.35c. per lb. *Flat, ⅛@¼-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.62½
Tin, 5-ton lots, New York			70.50
Lead (up to carlots) E. St. Louis	7.40	New York	8.25
Zinc (up to carlots) E. St. Louis	6.82½	New York	7.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	14.00	18.50	16.25
Copper sheets, base	21.50	22.00	21.50
Copper wire, base	18.37½	18.87½	14.75
Copper bars, base	21.12½	21.62½	21.12½
Copper tubing, base	23.50	24.00	23.50
Brass sheets, high, base	17.87½	18.37½	17.87½
Brass tubing, high, base	22.75	23.25	22.25
Brass rods, high, base	15.62½	16.12½	15.62½
Brass wire, high, base	18.37½	18.87½	18.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	27.00	26.02
Zinc sheets (casks)	13.00	12 30	11.36
Solder (½ and ½), (case lots)	42.37½	43.75	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			88.00
Commercial genuine, intermediate grade			61.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			13.25
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.37½@11.62½	10.25	10.50@11.00
Copper, heavy, and wire	10.62½@11.12½	10.50	9.50@10.00
Copper, light, and bottoms	9.25 @ 9.75	9.00	8.50@ 9.00
Heavy lead	6.25 @ 6.50	6.25	5.75@ 6.25
Tea lead	4.50 @ 4.75	4.25	4.75@ 5.25
Brass, heavy, yellow	7.00 @ 7.25	7.00	6.50@ 7.00
Brass, heavy, red	9.00 @ 9.25	9.25	8.75@ 9.25
Brass, light	5.50 @ 5.75	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.75	7.25	7.00@ 7.50
Zinc	4.12½@ 4.37½	4.00	3.00@ 3.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	6.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.17@.17½	36.00 per M	.15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	.04	.03½	.04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.81½	.98	.80
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.55	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.33	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.1562½	.1587½	.1687½
Solder (½ and ½)	per lb.	.4237½	.4012½	.4662½
Cotton waste	per lb.	.13@17½	.13@.17½	.15@.22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.33	.33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.13*	$4.95	$5.13
Emery paper	10.71*	9.15	10.71
Emery cloth	27.84*	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	3.35@3.50
Coke, prompt foundry, per net ton		Connellsville,	4.00@5.00
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry,	100 lb. kegs	New York,	15.25
Red lead, in oil,	100 lb. kegs	New York,	16.75

*4½ reams and under.

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{7}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount*for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all dia meters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ¾-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Boston—Atlas Tool & Machine Co., 463 Commercial St.—Universal milling machine, 10 x 42 table.

Mass., Salem—Dow & Lewis, 102 Lafayette St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $75,000.

Mass., South Boston (Boston P.O.)—C. H. Dailey, 454 Broadway—miscellaneous tools and equipment for proposed repair and service garage at 4th and K Sts. Estimated cost $45,000.

Mich., Muskegon — Panyard Machine & Mfg. Co.—machinery and equipment for proposed 1 story, 100 x 161 ft. piston ring factory. Estimated cost $40,000.

N. H., Rochester—Rochester Realty Co.—miscellaneous tools and equipment for proposed repair and service garage at Hanson and Wakefield Sts. Estimated cost $55,000.

O., Columbus—Fuller Auto Co., 262 South Third St., D. J. Buckley, V. Pres. and Mgr.—complete equipment for service station at Third and Rich Sts.

Tex., Lufkin—Boynton Lumber Co., A. L. Boynton—complete machinery and equipment to cost about $30,000 for proposed planing mill.

Ont., Kitchener — Mitchell Button Co., Victoria St., W. E. Mitchell, Pres.—special equipment for the manufacture of all kinds of buttons, for proposed new factory. Estimated cost $50,000.

Ont., Wallaceburg—Ontario Boat & Engine Co., J. Beebe, Mgr.—general equipment including motors, parts, etc., for the manufacture of high speed motor boats for recently acquired factory. Estimated cost $40,000.

Que., Montreal—Laval Construction Co., Ltd., 4740 Iberville St.—complete equipment for forge, etc.

N. Z., Auckland—New Zealand Government Railways will receive bids until June 13 for 4 overhead cranes, 6 lathes, 36 drills, milling machines, blowing fans, shaping machines, mechanical hammers, furnace for forging machine, flangers, etc.

Opportunities for Future Business

Ala., Birmingham—R. Hoe & Co., Inc., 504 Grand St., New York, N. Y., manufacturers of printing machinery and saws, plans the construction of a group of buildings for plant on Sixth Ave., here. Estimated cost $1,000,000. Private plans.

Calif., Los Angeles—White Motor Co., 842 East 79th St., Cleveland, O., awarded contract for the construction of a repair shop and service station here. Estimated cost $700,000.

Calif., San Francisco — City plans an election to vote $3,500,000 bonds for railway extensions including new shops, car barns, etc. M. M. O'Shaughnessy, City Engr.

Calif., San Francisco—O'Brien Bros., 315 Montgomery St., Archts., are receiving bids for the construction of a 4 story garage on Latham Pl. for Vukicevich & Lacey, Hearst Bldg. Estimated cost $200,000.

Calif., San Francisco — Pacific Gear & Tool Co., 1035 Folsom St., awarded contract for the construction of a 1 story, 40 x 40 ft. machine shop at Harriet and Folsom Sts.

Calif., Santa Barbara — Santa Barbara County plans the construction of a machine shop and garage. Estimated cost $25,000.

Conn., Westport — L. Gault, Riverside Ave., awarded contract for the construction of a 3 story, 75 x 150 ft. garage. Estimated cost $125,000. Noted Feb. 3.

Ill., Chicago—Chicago Coated Board Division of Robert Gair Co., C. R. Engle, Engr., 420 East North Water St., will soon award contract for the construction of a 2 story, 28 x 78 ft. addition to machine shop. Private plans.

Ind., Hammond—J. Marley, 5 North La Salle St., Chicago, Ill., manufacturers of steel stampings, will soon receive bids for the construction of a factory at Columbia and 151st Sts., here. Estimated cost $35,000.

Ind., Indianapolis — W. F. Kernodle, Frankfort, awarded contract for the construction of a 6 story, 77 x 104 ft. garage at Kentucky Ave. and Maryland St. here. Estimated cost $250,000. Noted Feb. 10.

Kan., Augusta — Spencer Trailer Co., F. G. Spencer, will build a 1 story, 60 x 300 and 60 x 100 ft. trailer factory and warehouse. Estimated cost $150,000.

La., Leesville—W. L. Brown, 2008 Polk St., Alexandria, will build a hardwood mill here. Estimated cost $100,000.

Mass., Boston—H. E. Cline, 43 Tremont St., will build a 1 story, 150 x 250 ft., repair and service garage at 613-627 Columbia Rd. Estimated cost $75,000. Private plans.

Mass., Chelsea (Boston P.O.)—S. Kysnes, 142 Webster Ave., will build a 1 story repair and service garage at 682-690 Broadway. Estimated cost $40,000. G. Powell, 64 Pleasant St., Dorchester, Archt.

Mass., Dorchester (Boston P. O.)—H. E. Cline, 43 Tremont St., Boston, will build a 1 story repair and service garage at 613-627 Columbia Rd., here. Estimated cost $75,000. Private plans.

Mass., Lynn—C. Bell, 385 Broad St., is having plans prepared for the construction of a 1 story repair and service garage on Broad St. Estimated cost $50,000. G. A. Cornet, 10 Central Ave., Archt.

Mass., Lynn — Gallant Motor Co., 319 Essex St., is having plans prepared for the construction of a 1 story repair and service garage. Estimated cost $50,000. G. A. Cornet, 10 Central Ave., Archt.

Mass., Lynn—General Electric Co., A. E. Trundinger, 920 Western Ave., will build an addition to forge shop. Private plans.

Mass., Newburyport — Dole-Collins Inc., 112 Merrimack St., plans the construction of a 1 story garage and repair shop on State St. Estimated cost $40,000. Architect not selected.

Mass., Revere (Boston P. O.)—F. T. Foley, 1499 North Shore Rd., is receiving bids for the construction of a 11 story, 75 x 100 ft. repair and service garage at Devon St. Estimated cost $80,000. Private plans. Noted Feb. 24.

Mich., Detroit—Dept. of Street Railways, St. Jean and Shoemaker Aves., plans the construction of a 1 story car barn and garage on Coolidge Ave. Estimated cost $280,000. Private plans.

Mich., River Rouge (Detroit P. O.)—Detroit City Gas Co., Clifford St., Detroit, awarded contract for the construction of a 1 story, 50 x 68 and 57 x 115 ft. garage and service building. Estimated cost $50,000.

N. J., Kearny — Western Electric Co., awarded contract for the construction of a 6 story plant. Estimated cost $260,000.

N. J., Trenton—Golding Sons Co., Peace St., manufacturers of flint and spar, plans the construction of a plant, 2 units, 60 x 120 ft. on New York Ave. Estimated cost $250,000. W. E. Dyer Co., Land Title Bldg., Philadelphia, Pa., Archt. and Engr.

N. Y., New York—New York Post Service Station, Inc., J. Gleason, Secy., 165 Broadway, is having plans prepared for the construction of a 3 story, 200 x 310 ft. machine shop, garage, etc., at 33rd and 34th Sts. Estimated cost $500,000. H. A. Koelble, Bible House, Astor Pl., Archt. U. S. Government, H. New, Postmaster General, Washington, D. C., lessee.

N. C., Wilson—Hackney Wagon Co., plans to rebuild portion of plant recently destroyed by fire. Loss is estimated cost $300,000.

O., Columbus — Huster Realty Co., 1 South Fourth St., is having sketches made for the construction of a 2 story, 57 x 92 ft. repair and service garage. Estimated cost $50,000. Private plans.

O., Columbus—National Garages, Inc., 1432 Buhl Bldg., Detroit, Mich., awarded contract for the construction of a 5 story, 160 x 187 ft. garage on East Town St., here. Estimated cost $400,000.

Pa., Hatboro—Roberts & Manders Stove Co., 11th St. and Washington Ave., Philadelphia, will receive bids until Mar. 15, for the construction of a 3 story, 60 x 214 and 66 x 199 ft., also 1 story, 41 x 111 ft. plant here. Private plans.

Pa., Jenkintown — Cole Chevrolet Co., will soon award contract for the construction of a 2 story, 26 x 141 ft. sales and service station on Old York Rd. C. L. Caspary, 1510 Chestnut St., Philadelphia, Archt.

Pa., Wilkes-Barre — The Wilkes-Barre Ry. Corp., W. S. Bell, V. Pres. & Gen. Mgr., 728 Miners Bank Bldg., awarded contract for the construction of car repair shops including 121 x 201 ft. machine shop and 121 x 151 ft. carpenter shop, etc., both 1 story. Estimated cost $250,000.

R. I., Providence—Henry L. Scott Co., Blackstone St., had plans prepared for the construction of a 2 story, 50 x 70 ft. addition to machine shop. Estimated cost $40,000. F. P. Sheldon & Sons, 1008 Hospital Trust Bldg., Archts.

Tex., Lufkin—Boynton Lumber Co., c/o A. L. Boynton, having plans prepared for remodeling plant here, for hardwood and pine mill, including dry kilns, planing mill, etc. $40,000.

Wis., Antigo—Vulcan Last Co., plans the construction of a kiln building. Estimated cost $50,000. Architect not selected.

Wis., Madison — Central Garage Co., Webster St., will build a 4 story, 60 x 150 ft. service station. Estimated cost $40,000. Claude & Starch, Badge Annex, Archts.

Wis., Mazomanie—The City Garage, M. Bohn, plans the construction of a 2 story service station and shop on Main St. Estimated cost $40,000. Architect not selected.

Ont., Brockville—E. F. Phillips Electrical Works, 12 Mercer St., Toronto, plans the construction of two wire and cable manufacturing buildings, one for cotton covering department and one for enameled wire department, here. Estimated cost $200,000. J. M. Miller, 364 Dorchester St. W., Montreal, Que., Archt.

Ont., Oshawa — General Motors Co. awarded contract for the construction of a 1 and 2 story factory on Division St. Estimated cost $300,000.

Ont., Toronto — Hobbs Storage Battery Co., Ltd., Federal Bldg., Toronto, is having plans prepared for the construction of a 3 story factory at Spadina Ave. and Fleet St. Estimated cost $100,000. A. J. Stringer, McLean Ave., Archt.